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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 14, NUMBER 8
APRIL 15, 1981

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A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

DETERMINATION OF DEUTERIUM/HYDROGEN RATIOS IN NATURAL WATERS BY FOURIER TRANSFORM NUCLEAR MAGNETIC RESONANCE SPECTROMETRY,
Hong Kong Univ. Dept. of Chemistry.
For primary bibliographic entry see Field 7B.
W81-01244

MASS SPECTROMETRIC DETERMINATION OF DEUTERIUM IN WATER AT NATURAL LEVELS,
Australian Atomic Energy Commission Research Establishment, Lucas Heights.
For primary bibliographic entry see Field 5A.
W81-01246

2. WATER CYCLE

2A. General

HAWAIIAN GROUNDWATER GEOLOGY AND HYDROLOGY, AND EARLY MATHEMATICAL MODELS,
Hawaii Univ., Honolulu. Water Resources Research Center.
J. F. Mink, and L. S. Lau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157117, Price codes: A05 in paper copy, A02 in microfiche. Technical Memorandum Report No 62, September, 1980. 74 p, 11 Fig, 3 Tab. OWRT-A-077-HI(1), 14-34-0001-9013.

Descriptors: *Aquifer characteristics, *Hydrogeology, *Groundwater, *Mathematical models, Confined aquifers, Unconfined aquifers, Convection-transport phenomena, Basalts, *Hawaii, Hydraulic conductivity, Basalts, Extrusive rocks, Intrusive rocks, Ghyben-Herzberg lens, Tidal efficiency.

This report is comprised of four papers: (1) Composition and Hydrologic Character of Hawaiian Rocks, (2) Hydrologic Behavior of Hawaiian Ghyben-Herzberg Lens, (3) Critique of Early Mathematical Models, and (4) Bottom Storage: A Review of its Origin and Evolution and a Critique of its Validity. The first paper evaluates and summarizes the existing information pertaining to the hydrologic properties, including hydraulic conductivity of Hawaiian basaltic rock. The second paper evaluates and summarizes the existing factual information pertaining to the behavior of Hawaiian basal (Ghyben-Herzberg) lens. The third paper is a critique of three early mathematical groundwater models: Hoyt's mechanical testing, Wentworth's statistical correlation, and TEMPO's numerical model. The fourth paper is an assessment of Wentworth's concept on bottom storage of a thick lens. The intent of this series of papers is to provide an evaluated summary of important data, concepts, and methodologies developed in Hawaii over the many decades with particular reference to the unusual hydrologic and geologic volcanic and oceanic environments. These publications and unpublished material are scattered and generally not evaluated; many of them are not readily available. The four papers are an attempt to fill this information gap.
W81-01376

2C. Snow, Ice, and Frost

ICE SHEET FORMATION FROM DEPOSITED SNOW IN HIGHLY ACIDIC LAKE KATANUMA,
National Inst. for Environmental Studies, Yatabe (Japan).
K. Satake.
Japanese Journal of Limnology, Vol 41, No 2, p 68-74, April, 1980. 6 Fig, 2 Tab, 9 Ref.

Descriptors: *Ice-water interfaces, *Lake ice, *Ammonia, Nutrients, Ice cover, *Acidic water, Melt water, Snow, Lake Katanuma, Japan.

The mechanism of alternate milky ice and firm ice formation on the highly acidic Lake Katanuma (Japan) was investigated. The chemical constituents of the ice sheets and the snow in the area were similar, as were the chemical constituents of the water layers found between the ice layers and the lake water. There were chemical differences between the water and ice layers. It is suggested that first the lake water freezes, then snow is deposited on the ice sheet. The ice sheet may sink slightly under the weight of the snow, causing the water to penetrate the underside of the deposited snow. The content of ammonia in the snow and ice sheets (1.06-3.56 microgram-at/liter) was comparable to the maximum level found in the lake in April and July. These results suggest that the supply of ammonia from melted snow and ice is one of the main sources of nitrogen nutrients in the lake. (Small-FRC)
W81-01264

A COMPARATIVE STUDY OF MICROWAVE RADIOMETER OBSERVATIONS OVER SNOWFIELDS WITH RADIOACTIVE TRANSFER MODEL CALCULATIONS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
A. T. C. Chang, and J. C. Shiue.
Remote Sensing of Environment, Vol 10, No 3, p 215-229, November, 1980. 12 Fig, 1 Tab, 18 Ref.

Descriptors: *Data collection, *Snowpacks, *Water sources, Water equivalent, Instrumentation, Remote sensing, Snow, Water cycle, Measurement, Radiometer, Snowmelt, Melt water, Water yield, Water supply, Runoff forecasting.

A truck-mounted microwave system experiment performed to study the microwave emission characteristics of snowpacks in the Colorado Rocky Mountain region during 1977-1978 is described. Spectral signatures of 5.0, 10.7, 18, and 37 GHz radiometers with dual polarization were measured, together with observations of snowpack density and temperature profiles, ram profile, and free water content. Data thus collected compare favorably with results calculated from microscopic scattering techniques. Variations in the snow accumulation and snow metamorphosis appeared as variations in passive microwave brightness temperatures observed by the truck-mounted radiometer. For a relatively homogeneous snowpack the microwave brightness temperatures for various microwave frequencies may be calculated with an accuracy of 5-10 K by a simple scattering model. This uncertainty translates into a 2.5-5 cm error in snow depth estimates and a 0.6-1.25 cm error in water equivalent estimates. The presence of melt water in the snowpack drastically changes the microwave emission characteristics, resulting in as much as a 50 K increase in brightness temperature over a dry cross section snow condition. The only information which it is possible to glean from that situation would be that the snowpack is in the process of melting. (Baker-FRC)
W81-01283

MODIFICATION OF THE TIDE IN THE CANADIAN ARCTIC BY AN ICE COVER,
Department of Fisheries and Oceans, St. John's (Newfoundland).
G. Godin.
Manuscript Report Series No 56, 1980. 29 p, 8 Fig, 5 Tab, 7 Ref.

Descriptors: *Arctic, *Ice cover, *Tides, *Water level fluctuations, *Canada, Bays, Straits, Climatic zones, Cold regions, Bodies of water, Surface waters, Regions, Ice, Climatology, Ice breakup, Ice-water interfaces, Water levels, Correlation analysis, Variability, Research and development, Evaluation, Harbors.

Objective criteria were sought for verification that ice cover might modify the tide in the arctic. Those tested were comparisons between: predicted tide at a local site and the observed water level (or the latter at an ice-free harbor and the local level); the mean time internal between lunar transit and local occurrence of high/low water; the power spectrum of the observed levels in various frequency bands and tide range (height difference between high and low water). None of these criteria provided an unequivocal answer. Together they indicated that the tide is unmodified at sites in good contact with the deep ocean, but modified at sites removed from the open ocean by shallows or in deep recesses of water bodies (Hudson Bay). Also, ranges appeared higher during open water and the tide arrival time was changed. Lake Harbour in Hudson Strait is unaffected; Coral Harbour and Churchill exhibit larger and later tides during the open water season. It was concluded that a seasonal change in the character of the Canadian arctic tide is a function of geography and does not affect stations lying around the perimeter of the ocean or connected to it by deep channels. (Zielinski-IPA)
W81-01412

2D. Evaporation and Transpiration

CROP WATER SUPPLIED BY CONTROLLED AND REVERSIBLE DRAINAGE,
Science and Education Administration, Florence, SC. Coastal Plains Soil and Water Conservation Research Center.
C. W. Doty.
Transactions of the ASAE, Vol 23, No 5, p 1122-1126, 1130, October/Novermber, 1980. 3 Fig, 2 Tab, 11 Ref.

Descriptors: *Irrigation practices, *Controlled drainage, Consumptive use, Permeability, Corn, Evapotranspiration, Soil moisture, Drainage, Soil-water-plant relationships, *Irrigation efficiency.

Corn was grown for 3 seasons on a 1.7 hectare plot using the controlled and reversible drainage system (CaRD). This method, useful in sandy loam soils with poor drainage during wet periods, was applied in this study to a moderately permeable soil not normally used for CaRD. Evapotranspiration data was determined. The estimated soil water storage was compared with the measured data obtained from tensiometer and suction release curves. These figures agreed closely enough so that it was possible to measure the water consumption of the corn crop for the 3-year period. Estimated irrigation needs were less than the water actually supplied by the CaRD system in 1975 and 1976, more in 1977. Although 1975 and 1976 crops were adequately irrigated, the 1977 crop did not receive sufficient water. Soil permeability was a limiting factor, evaportranspiration rates were very high, and tile spacings were too far apart for the climatic conditions. The CaRD system must be carefully designed if used in soils with permeability less than 3.0 meters per day because tile spacings would have to be closer than 15 m in hot, dry years. (Cassar-FRC)
W81-01277

2E. Streamflow and Runoff

STOCHASTIC GENERATION OF ANNUAL STREAMFLOWS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W81-01369

2F. Groundwater

MEASUREMENT OF DEPTH TO WATER TABLE IN A HEAVY CLAY SOIL,
Soil Survey Inst., Wageningen (Netherlands).
J. Bouma, L. W. Dekker, and J. C. F. M. Haans.
Soil Science, Vol 130, No 5, p 264-270, November, 1980. 4 Fig, 19 Ref.

Descriptors: *Water table, *Analytical techniques, *Tensiometers, Boreholes, Clays, Measurement, Piezometry, Soil water, Instrumentation, Groundwater basins, Depth, Potentiometric level, Soil water movement, Water level recorders.

The depth to water table was determined in spring in heavy clay soils using different techniques that would allow a physical evaluation of the process involved and determination of the most desirable procedures to be used in the future. The clay soils studied were at different locations in the riverine area along the Rhine River and until about 60 yr ago had been used extensively as meadows. They were classified as Typic Fluvaquents (very fine clayey, mixed, mesic). Methods of measurement included: a 1.2-m deep perforated pipe; two series of shallow, unlined boreholes to depths of 30 and 50 cm below the surface; and one series of piezometers to 30 cm. Pressure potentials were measured in duplicate by transducer tensiometry at 10-cm depth intervals. Different water levels were noted in the unlined boreholes at the shallow depths, while pressure potentials in surrounding soil were negative. Such water levels do not qualify as water tables, but result from preferential movement of water along larger continuous voids in the shallow holes while soil mass itself is unsaturated. It was concluded that small-diameter, shallow, unlined boreholes should not be used to determine depth to water table in clay soils that have preferential pathways for water movement. A series of piezometers at different depths would give acceptable results. A series of tensiometers is particularly valuable, as it allows determination not only in saturated, but also under unsaturated conditions. Deep, unlined boreholes with a small diameter yielded acceptable values in these experiments. (Baker-FRC)
W81-01279

HAWAIIAN GROUNDWATER GEOLOGY AND HYDROLOGY, AND EARLY MATHEMATICAL MODELS,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 2A.
W81-01376

2G. Water In Soils

DETERMINING IMPACT OF IRRIGATION ON GROUNDWATER,
Youngstown State Univ., OH. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W81-01370

SIMULATION OF FLOW PATTERNS AND ION-EXCHANGE IN SOIL PERCOLATION EXPERIMENTS. PART I. TRACER EXPERIMENTS AND FLOW MODEL,
Norsk Inst. for Vannforskning, Oslo.
K. Brustad, and A. Njos.
Water, Air, and Soil Pollution, Vol 13, No 4, p 459-472, December, 1980. 8 Fig, 16 Ref.

Descriptors: *Mathematical models, *Percolation, *Soil water movement, Flow measurement, Model studies, Soil moisture, Tracers, Radioisotopes, *Ion exchange.

A model to study the complex flow of water in soils was developed, using the concepts of the residence time theory, and using tritiated water as a tracer in humus. These models and experimental techniques will ultimately be applied to the study of natural systems. Tracer response curves were obtained with input in the form of a step function and as a short pulse. Both methods showed similar patterns, but a smoother residence time distribution curve was obtained from the pulse response technique. Observed residence time distribution curves showed that the commonly used simple axial dispersion model is not adequate to describe the flow. Results show that 2 types of flow occur in soil systems: rapid throughflow in large to medium-sized pores and very slow flow in smaller pores. The model is mathematically simple and easy to solve with a computer, and provides a good basis for subsequent models of a more complicated nature. (Cassar-FRC)
W81-01415

2H. Lakes

RESULTS OF A LIMNOLOGICAL STUDY OF LAKE POCASSE, SOUTH DAKOTA,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 5C.
W81-01238

ATTACHED AND PLANKTONIC ALGAL COMMUNITIES IN SOME INSHORE AREAS OF GREAT BEAR LAKE,
Alberta Environmental Center, Vegreville.
J. W. Moore.
Canadian Journal of Botany, Vol 58, No 21, p 2294-2308, 1980. 5 Fig, 7 Tab, 60 Ref.

Descriptors: *Algae, *Great Bear Lake(Canada), *Plankton, *Lakes, Sessile algae, Aquatic microorganisms, Aquatic plants, Standing crops, Aquatic algae, Canada, Alberta(Canada).

Species composition and standing crop of algae were determined in three areas of Great Bear Lake, Canada, during the summers of 1976-1978. Since this large, remote lake will eventually be subject to industrial development, it was desirable to determine background information to assess changes in environmental quality. Species composition and standing crop were similar in all three collection areas, because water chemistry and temperature were relatively uniform throughout the lake. Species commonly found in the epilithon were Tabellaria flocculosa, Achnanthes minutissima, and Ulothrix zonata. In the epipelon the most important species were Gyrosigma spenceri, Nitzschia obtusa, Cocconeis placentula, Amphora ovalis, and Achnanthes lanceolata. Maximum densities occurred in August or September, as follows: epilithon, 1,950,000 cells per square cm; epipelon, 4,000,000 cells per square cm. Plankton standing crops reached a maximum of 233 million to 301 million cells per cubic meter by September. Dominant species were Dinobryon bavaricum, Dinobryon sociale, Rhodomonas minuta, Cyclotella species Synedra acus var. radians, and Ankistrodesmus falcatus. All algae counts were among the lowest on record for freshwaters. Although available nutrients approach world average levels, low temperatures and violent summer storms are believed responsible for the small algae populations. Epilithon populations are different from other large North American Lakes. Epipelic compositions are similar to lakes in the western Arctic and different from lakes in Precambrian Canada and Scandanavia. (Cassar-FRC)
W81-01253

APPLICATIONS OF LANDSAT DATA FOR ESTIMATING PHYTOPLANKTON PRODUCTION IN LAKE CHAD (AFRICA). (APPLICATION DES DONNEES LANDSAT A L'ESTIMATION DE LA PRODUCTION DU PHYTOPLANCTON DANS LE LAC TCHAD),
Institut National de la Recherche Agronomique, Thonon-les-Bains (France).
J. Lemoalle.
Hydrobiologie, Vol 13, No 1/2, p 35-46, 1979-80. 9 Fig, 2 Tab, 31 Ref.

Descriptors: *Lakes, *Phytoplankton, *Aerial photography measurement, Reflectance, Chlorophyll, Optical properties, Remote sensing, Eutrophication, Lake Chad(Africa), *Africa, Landsat.

Lake surface radiance as measured by the Landsat satellite can be used to estimate the phytoplankton distribution and production when relationships between water transparency and chlorophyll are known. The conditions for the use of such satellite data, and application of the technique to Lake Chad (Africa) in 1975, are described. Mean gross production values in the open waters of the southern basin of the Lake Chad (an area of 1500 sq km) were estimated at 3.76 g 02 per sq m per day on June 22, 1975, and 0.91 g 02 per sq m per day on October 8, 1975. The corresponding ranges of chlorophyll concentration in mg of chlorophyll per cu m were 4-197 on June 22 and 0.8-14 on October 8. (Small-FRC)
W81-01262

MEASUREMENTS OF UNDERWATER SPECTRAL IRRADIANCE IN LAKE BIWA,
Kinki Univ., Osaka (Japan). Faculty of Agriculture.
R. Tsuda.
Japanese Journal of Limnology, Vol 41, No 2, p 57-67, April, 1980. 9 Fig, 2 Tab, 16 Ref.

Descriptors: *Lakes, *Optical properties, *Light quality, Opacity, Turbidity, Light intensity, Light penetration, Color, Coasts, Lake Biwa, Japan.

Secchi disk depths, beam attenuation coefficients, downward spectral irradiance, water color, and optical characteristics of the natural light field were investigated in Lake Biwa (Japan). Due to sometimes intense light absorption by suspended particulate solids, yellow suspended substances, and the water itself, both sides of the visible region of the downward spectral energy distribution were remarkably attenuated. The peaks in the spectral distribution were at about 560 nm in the south basin and at about 540 nm in the southern part of the north basin. Both basins were basically turbid coastal waters. The south basin and the north basin corresponded to optical water types 5 and 3, respectively, in Jerlov's optical classification scheme. In the lake, the value of KV (illuminance) times ZSD (Secchi disk depth) was 1.49, and the depth to which 1% of the surface illumination penetrated was 2.7 times as large as the Secchi disk depth. (Small-FRC)
W81-01265

LIMNOLOGICAL STUDIES ON INORGANIC ACID LAKES IN JAPAN (IN JAPANESE),
National Inst. for Environmental Studies, Yatabe, (Japan).
K. Satake.
Japanese Journal of Limnology, Vol 41, No 1, p 41-50, January, 1980. 1 Fig, 87 Ref. (English abstract).

Descriptors: *Acidic water, *Limnology, *Lakes, Fish, Zooplankton, Phytoplankton, Algae, Bacteria, Water chemistry, Reviews, Japan.

A review is presented of studies of inorganic acid lakes in Japan. Lake Katanuma (1915) and Lake Onumaike (1920) were the first lakes to be investigated. The typology of acid lakes was first investigated by Ueno. The biota of acid lakes was investigated by several researchers, who found Pinnularia braunii in Lake Katanuma, Brachionus urceoralis in Lake Ichibishinaiko, Leptodictyum and fish in Lake Osoresanko, and other algae, zooplankton and insects in various acid lakes. Anzai found that the deposition of iron compounds was followed by the occurrence of Pinnularia braunii. Studies made after World War II included investigations of the chemical composition of Lake Yugama, mold and bacteria in acid lakes, phytoplankton and zooplankton in the Kirishima lakes, and macrophytes and fish in Lake Osoresanko. Total CO2 and CO2 uptake in oxic and anoxic water was measured in Lake Katanuma, and the mechanism of sulfur-diatom lamination was clarified. Changes in biota caused by the acidification of Lake Tazawako and Lake Toyako were determined. (Small-FRC)
W81-01266

PHOSPHORUS RELEASE FROM SEDIMENTS FROM LAKE CARL BLACKWELL, OKLAHOMA,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
M. H. Bates, and N. J. E. Neafus.
Water Research, Vol 14, No 10, p 1477-1481, October, 1980. 4 Fig, 2 Tab, 19 Ref.

Descriptors: *Phosphorus, *Lakes, *Sediments, Aerobic, Anaerobic, Mixing, Sterility, Microorganisms, Dissolved oxygen, Bacteria, Lake Carl Blackwell(OK), Oklahoma.

A study was conducted in the laboratory to determine the effects of anaerobic vs aerobic conditions, sterile vs non-sterile conditions and mixing on the

release of soluble ortho-phosphate from sediments obtained from Lake Carl Blackwell, Oklahoma. Investigations were carried out for a 30-day experimental period utilizing eight laboratory systems which reflected the various combinations of the three specified environmental conditions. Phosphate release under non-sterile conditions exceeded the release observed under sterile conditions in all systems. Phosphate release in mixed systems exceeded the release in static systems in all conditions investigated. Anaerobic release of phosphates was greater than aerobic release in all except two cases. (McKeon-FRC)
W81-01339

A THREE-DIMENSIONAL FIELD EVALUATION AND ANALYSIS OF WATER QUALITY IN TWO RESERVOIRS,
Tennessee Technological Univ., Cookeville. Dept. of Civil Engineering.
J. A. Gordon, and S. A. Wells.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157083, Price codes: A08 in paper copy, A01 in microfiche. Tennessee Water Resources Research Center, University of Tennessee, Knoxville, Research Report No 79, August, 1980. 148 p, 27 Fig, 20 Tab, 120 Ref. OWRT-A-054-TENN(2), 14-34-0001-0145.

Descriptors: *Reservoirs, *Water quality, *Mathematical models, Theoretical analysis, Diffusion, Dispersion, Mixing, Physical properties, Lake morphology, Biological properties, Chemical properties, Data collections, Tennessee, *Center Hill Lake(TN), *Cherokee Lake(TN).

In formulating mathematical models for reservoir water quality, simplifying assumptions are often made with regard to the geometry of the model. For many lake and reservoir models, the assumptions of one-dimensionality (i.e., water quality changes are significant only in one dimension-usually depth), as well as two-dimensionality (considering the length and depth of the water body), have been utilized to predict water quality. In both cases, the assumption of lateral homogeneity is made. A field study was undertaken to determine the change of water quality in the lateral dimension. The main study reservoir was Center Hill Lake in Middle Tennessee. Data were also obtained for Cherokee Lake in East Tennessee. Several water quality parameters were analyzed over the length, breadth, and depth of these reservoirs from pre-stratification through post-stratification: temperature, dissolved oxygen, pH, conductivity, oxidation-reduction potential. The statistical and theoretical three-dimensional analysis showed the expected variation for each water quality parameter in each direction. The influence of the lateral dimension on water quality management and modeling was found to be negligible.
W81-01377

2J. Erosion and Sedimentation

SEDIMENT PRODUCTION OF ALLUVIAL CHANNELS IN RESPONSE TO BASE LEVEL LOWERING,
Geological Survey of Israel, Jerusalem.
Z. B. Begin, D. F. Meyer, and S. A. Schumm.
Transactions of the ASAE, Vol 23, No 5, p 1183-1188, October/November, 1980. 9 Fig, 3 Tab, 15 Ref.

Descriptors: *Base level, *Sediment discharge, *Alluvial channels, *Drainage, Running waters, Sediment load, Suspended solids, Mathematical models, Sediment transport.

An experimental study of the degradation of alluvial channels in response to base level lowering was carried out in flumes 15 meters and 20 meters long at slopes of 1%. Sediment discharge was measured and a power function decay of sediment discharge with time with an exponent close to -0.5 was noted. An equation was developed from the data to describe sediment discharge. Variables included mean width and initial constant slope of the channel and amount of base level lowering. Channel armoring, which produced an abrupt decrease in sediment discharge, was a prominent effect during the runs. The equation was extended by computer simulation to a simple drainage net. Location of tributaries had a marked effect on the amount of sediment produced as a function of base lowering. (Cassar-FRC)
W81-01269

CHARACTERISTICS OF ERODED SEDIMENT.
Science and Education Administration, Morris, MN.
R. A. Young.
Transactions of the ASAE, Vol 23, No 5, p 1139-1142, 1146, October/November, 1980. 3 Fig, 3 Tab, 32 Ref.

Descriptors: *Sedimentology, *Soil aggregates, *Erosion, Sediment sorting, Slopes, Soil erosion, Particle size.

Eroded sediments are characterized to develop guidelines to use in sediment prediction models. Data from the literature and from unpublished recent studies are reviewed and summarized. Soil particle detachment and transport depends on particle size distribution, density, and degree of aggregation of the matrix soil. Clay and silt aggregates in the 20 to 200 micrometers range are more erodible than larger or smaller particles. Very sandy soils, not well aggregated, erode as primary particles, with the sediment particle size distribution similar to that of the matrix. Soils composed of greater than 50% sand or clay produce sediment with particles larger than 50 micrometers. High clay soils form a considerable amount of sediment particles larger than 1000 micrometers. Soils high in silt produce sediment largely in the 20 to 35 micrometer range. Aggregate density averages about two thirds that of primary particles and varies inversely with the amount of silt in the soil. Vegetative cover affects the particle size of eroded material, generally increasing fines and decreasing coarse particles as cover increases. However, tillage practices affect these relationships and should be further studied. Percentage of coarse material (greater than 50 micrometers) transported increases with slope up to 10%, then remains constant to the highest level tested, 32%. (Cassar-FRC)
W81-01275

SAND BED INSTABILITY DUE TO BED LOAD MOTION,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
H. Nakagawa, and T. Tsujimoto.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY12, p 2029-2051, December, 1980. 13 Fig, 1 Tab, 25 Ref.

Descriptors: *Model studies, *Movement, *Bed load, Flow rates, Stochastic processes, Sand bars, Dunes, Waves, Sediments, Suspended solids, Sand waves, Geology, *Sediment transport, Sediment load, Fluctuations, Hydraulics.

Previous research has illustrated that the lag of sediment transport for bed form has a great impact on sand bed instability. As of yet this lag has not successfully been quantitated. The present study seeks to clarify the role and constitution of the lag by examining the instability analysis and comparing it with theories on the process of bed load transport rate. The applicability of this model was verified by devised experiments using a movie camera and a film motion analyzer. The flow model based on potential flow theories has been improved by taking into account the effect of flow acceleration or deacceleration, which may be represented by local fluctuations in flow depth. This allows estimations of the phase lag between bed shear stress and bed form to be made. Investigations into the relationships between bed surface instability and hydraulic conditions were also carried out. Results confirmed those of previous investigators, but no added information was gained on the formation of antidunes migrating downstream. (Geiger-FRC)
W81-01368

2K. Chemical Processes

PROCESS AND PLANT FOR THE RECOVERY OF WATER FROM HUMID AIR,
Maschinenfabrik Augsburg-Nuernberg (Germany, F.R.). (Assignee).
W. Bulang.
U.S. Patent No 4,197,713, 4 p, 2 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 792, April 15, 1980.

Descriptors: *Patents, *Meteoric water, *Water vapor, Precipitable water, Humidity, Adsorption, Heat exchangers, Condensation, Heat, Equipment.

A process and a plant for the recovery of water from humid air are disclosed. Humid ambient air flows through an adsorber in which an adsorbing agent removes moisture from the air by adsorption. Subsequently, air heated by an air heater and delivered by a fan flows through the adsorber in order to recover by desorption the moisture. Then the water vapor containing air is precooled in a counterflow heat exchanger and subsequently conducted into a condenser in which heat is extracted from it by means of a heat pump so that the water vapor condenses and is available in the form of liquid water. The air cooled and dried in the condenser is utilized in the counterflow heat exchanger for precooling the air fed into the condenser. The heat given off by the heat pump is supplied to the air heater in order to be utilized for heating the air flowing through the air heater. (Sinha-OEIS)
W81-01425

2L. Estuaries

THE SIGNIFICANCE OF THE ENTRAPMENT ZONE LOCATION TO THE PHYTOPLANKTON STANDING CROP IN THE SAN FRANCISCO BAY-DELTA ESTUARY,
Water and Power Resources Service, Sacramento, CA.
J. F. Arthur, and M. D. Ball.
Report, November, 1980. 101 p, 28 Fig, 6 Tab, 38 Ref.

Descriptors: *Estuaries, *Phytoplankton, *Standing crops, *Euphotic zone, California, Diatoms, Settling velocity, Inflow, Chlorophyll, Inorganic compounds, Nutrients, Water chemistry, Specific conductivity, *San Francisco Bay-Delta Estuary.

A study conducted during the summer of 1978 in the upper San Francisco Bay-Delta Estuary of California further supported the theory that phytoplankton standing crops are highest when the entrapment zone is adjacent to the expansive shallows of Suisun Bay. The photic zone in the shallows of Suisun Bay constitutes a greater percentage of the total depth than in the channels. The entrapment zone was maintained in Suisun Bay from mid-July through October 1978 by regulating Delta outflow through operational control of the Federal and State water projects. Maximum phytoplankton concentrations occurred when the tidally averaged position of the entrapment zone was in the vicinity of Honker Bay. Delta outflows of 140 to 230 cubic m/s were required to maintain the entrapment zone in this location. Forty-one species of phytoplankton were identified, with the diatom Thalassiosira excentricus being the most numerous. The settling rate of T. excentricus is nearly equal to the maximum net upward vertical velocity in the water column. The settling of the diatom from the downstream-flowing surface layer into the upstream-flowing bottom layer is the theorized mechanism by which these organisms are concentrated in the entrapment zone. High chlorophyll concentrations, as well as the lowest inorganic nitrogen and orthophosphate levels, were observed in water with specific conductances of 5-14 millimho/cm. Results indicate that the phytoplankton standing crop in Suisun Bay can be regulated, within water availability limits, by manipulating Delta outflow to optimize the entrapment zone location. (Moore-SRC)
W81-01225

REEXAMINATION OF THE WATER CHEMISTRY AND PLANKTOLOGY OF A DELAWARE TIDAL STREAM AS RELATED TO ITS FLUSHING CHARACTERISTICS,
Delaware Univ., Newark. Coll. of Marine Studies.
F. C. Daiber, E. M. Simek, and M. Van House.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157091, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware Technical Completion Report, November, 1980. 57 p, 16 Fig, 3 Tab, 44 Ref, 3 Append. OWRT-A-044-DEL(1), 14-34-0001-0108.

Descriptors: *Zooplankton, *Water chemistry, Water quality, Hydrography, *Delaware Bay, Estuaries, Sewage pollution, Flushing time, Tidal streams, Nutrients, *Tidal effects, *Murderkill River estuary.

In the early 1970's, the zooplankton communities of the Murderkill and Broadkill Rivers were investigated and found to be different. At that time, the Murderkill was an unperturbed system whereas the Broadkill received considerable point source pollution. It was concluded that water quality degradation in the Broadkill was responsible for the observed differences in the zooplankton communities. Since 1973, the Kent County Regional Sewage Treatment Plant (STP) has been discharging nutrients and biodegradable material into the Murderkill River. Based on the earlier study, it was predicted that the zooplankton community in the Murderkill would since have shifted toward that which was found in the Broadkill. The present investigation, a reexamination of the water quality and zooplankton community of the Murderkill, was conducted to test this hypothesis. Statistical comparisons of water quality data between the previous and present studies show that water quality has changed since the STP began operating. Ammonium and nitrite concentrations have increased significantly below the plant, and dissolved oxygen has decreased. Phosphate and nitrate concentrations increased both upstream and downstream of the plant. Changes in chlorphyll-a concentrations were inconclusive. In general, the composition of the zooplankton community has remained relatively stable since the STP began operations. Specific changes in species composition associated with the water quality degradation on the Broadkill River did not occur on the Murderkill, nor were there any of the changes associated in the literature with the classic conditions of eutrophication.
W81-01375

MODIFICATION OF THE TIDE IN THE CANADIAN ARCTIC BY AN ICE COVER,
Department of Fisheries and Oceans, St. John's (Newfoundland).
For primary bibliographic entry see Field 2C.
W81-01412

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3C. Use Of Water Of Impaired Quality

EXTENDED USE OF TREATED MUNICIPAL WASTE WATER BY THE BUCKEYE IRRIGATION COMPANY: A DOCUMENTATION OF EFFECTS,
Arizona Water Resources Research Center, Tucson.
C. B. Cluff, T. C. Tucker, A. D. Day, J. A. McFadyen, and P. G. Sebenik.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156630, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, September, 1980. 29 p, 6 Fig, 19 Tab, 3 Ref, 2 Append. OWRT-A-050-ARIZ(4), 14-31-0001-5003.

Descriptors: *Waste water disposal, *Municipal wastes, Irrigation water, *Irrigation practices, *Cost-benefit analysis, Farm prices, Irrigation programs, Irrigation systems, Irrigated land, Irrigation efficiency, Water utilization, Waste water treatment, Environmental sanitation, Nitrates, Groundwater, Profit, Water costs, Water sources, Water supply, *Water reuse, Arizona.

The treated effluent use by the Buckeye Irrigation Company is the largest in the State of Arizona. It is unique in that it is used by an irrigation district. This two-year study addressed three objectives: (1) identify changes during an extended period of application of treated waste water to irrigated fields (in irrigation and fertilization practices, cropping patterns, crop yield response/equality, irrigation water quality, and soil properties); (2) make a preliminary evaluation of the effects of effluent use on groundwater conditions; and (3) make a preliminary evaluation of changes in water costs and farm profits. Most of these initial objectives were achieved. Groundwater nitrate concentration showed an accelerating increase possibly due to continued use of fertilizer practice during waste water use. In general, more nitrate-nitrogen was deposited on pump water irrigated fields than on fields irrigated with waste water-pump water mixtures, while the latter provided higher total nitrogen due to waste water organic nitrogen. Pump-waste water use generated considerably less total soluble salts and about 4 parts-per-million phosphorus. Little or no change occurred in irrigation or fertilization practices, or in cropping patterns. Waste water use varied from 100% in winter to about two-thirds of the crop demand in the summer. (Zielinski-IPA)
W81-01208

TREATMENT AND DISPOSAL OF SUGARBEET PROCESSING WASTE WATER BY IRRIGATION,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
J. H. Smith, and C. W. Hayden.
Science and Education Administration, Department of Agriculture, Conservation Research Report No 25, September, 1980. 59 p, 3 Tab, 32 Ref, 1 Append.

Descriptors: *Irrigation, *Waste water treatment, *Waste water disposal, *Food processing industry, Industrial wastes, *Water reuse, Flood irrigation, Idaho, Alfalfa, Grasses, Soil chemistry, Soil water, Water chemistry, Nitrates, Chemical oxygen demand.

Irrigation with sugarbeet processing waste water was studied at three locations in Idaho for 2 or 3 years where perennial grass and alfalfa were irrigated by flooding specially graded fields. Experimental sites were scheduled for irrigation at intervals of 1, 2, or 4 weeks. The weekly irrigated plots were discontinued after 1 year because of excess loading. Waste water samples from the sugar factories and water samples extracted from the soil at depths of from 15 to 150 cm were analyzed for chemical oxygen demand, total nitrogen, phosphorus, potassium, electrical conductivity, calcium, magnesium, sodium, sodium absorption ratio, pH, chlorine, sulfate, and bicarbonates. Soil and plants were also analyzed for selected constituents. Water applications range from 28 to 201 cm/year and chemical oxygen demand applications ranged from 8 to 140 metric tons/hectare. Chemical oxygen demand reductions in the waste water at Twin Falls averaged 48% in winter and 98% in summer; at Rupert, it averaged 84% in winter and 98% in summer; and at Nampa, it averaged 75% in winter and 88% in summer. Nitrates found in water samples extracted from 150 cm in the soil were mostly below 10 parts per million. Irrigation with sugarbeet processing waste water works well in the field. (Moore-SRC)
W81-01220

DAIRY OPEN LOT AND LAGOON-IRRIGATED PASTURE RUNOFF QUANTITY AND QUALITY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
P. W. Westerman, and M. R. Overcash.
Transactions of the ASAE, Vol 23, No 5, p 1157-1164, 1170, October/November, 1980. 6 Fig, 13 Tab, 20 Ref.

Descriptors: *Farm wastes, *Agricultural runoff, *Rainfall-runoff relationships, Dairy industry, Pasture management, Farm lagoons, Nitrogen, Ultimate disposal, Waste water disposal, Water pollution, Runoff, *Irrigation water.

The quality and quantity of rainfall runoff from a dairy open lot and a pasture irrigated with water from dairy lagoon effluent (1 cm every other week) were determined. Over a 30-month period 21% of rainfall on the open lot became runoff and 10% on the pasture. Average nitrogen runoff yield was 234 kg per hectare-year in the lot and 24.8 kg per hectare-year in the pasture. Of 936 kg nitrogen per hectare applied to the pasture during a year, 2.6% was transported. Compared with previous data for beef feedlots and dairy lots of higher stocking density, nutrient concentrations in the lot were lower. Runoff concentrations from the pasture compared with data obtained elsewhere for plots receiving similar loadings of animal wastes. In general, concentrations of nitrogen, phosphorus, total organic carbon, and chloride were 4 to 6 times greater in the lot runoff than in the pasture runoff. (Cassar-FRC)
W81-01272

PRELIMINARY INVESTIGATIONS INTO THE EFFECTS OF REFINERY WASTE WATER, AND THE SINGLE EFFECT OF ITS MAJOR POLLUTANTS ON COMMERCIALLY INTERESTING CROPS,
G. A. Al-Nakshabandi, Z. Hameed, A. Abdulhadi, and B. Saleem.
Progress in Water Technology, Vol 12, No 3, p 109-117, 1980. 4 Fig, 2 Tab, 4 Ref.

Descriptors: *Crop response, *Industrial water, *Oil industry, Phenols, Oil, Barley, Corn, Alfalfa, Vegetable crops, Hydrogen sulfide, Ammonia, Refinery wastes, Irrigation practices, Water reuse.

The effects of refinery waste water and irrigation water containing NH3, H2S, oil, and phenol on commercial crops were investigated. Corn, barley, alfalfa, and radish were irrigated with solutions containing varying amounts of one of the pollutants, or with a dilution of API separator discharge from KNCP. Germination of the field crops was not affected by any of the pollutants; however, radish germination was retarded by 100% and 75% solutions of refinery waste water. Growth rates of radish, barley, and corn did not differ significantly from controls under all treatments. Alfalfa was affected. Thus, most crops tolerated the different types and concentrations of pollutants, except for heavily polluted waste water used in one test. (Small-FRC)
W81-01315

WASTE HEAT UTILIZATION THROUGH SOIL HEATING,
Cold Region Research and Engineering Lab., Fairbanks, AK.
T. McFadden, and J. Buska.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 105-117. 8 Fig, 1 Tab, 13 Ref.

Descriptors: *Alaska, *Cold regions, *Agricultural enhancement, *Soil heating, Powerplant cooling water, Plant growth, Crop response, Crops, Vegetable crops, Beans, Lettuce, Sweet corn, Ice fog, Growing season, Cooling water, Water reuse.

Warm cooling water discharged from the Fort Wainwright powerplant near the University of Alaska was used for agricultural enhancement by soil heating. Despite long hours of daylight, the growing season in the far north is severely restricted by cold soil temperatures. Warmer soil allows the growth of several warm season crops not normally possible in Alaska, and increased yield on crops normally grown. Two test plots and a control plot were prepared. The test plots had buried heating pipes that used 2,000 gallon per minute of diverted power plant cooling water. The diverted

water had a temperature range of 10 to 38C. Results of harvested crops show that the heated plots outproduced the unheated control plot in every case except for one species of lettuce. Crops tested include sweet corn, broccoli, cauliflower, lettuce, spinach, beans, peas, and zucchini. Increased crop yields as high as 425% were obtained with corn and multiple harvests were possible with some crops. An added advantage of this use of waste heat from powerplant cooling water is the reduction of the ice fog caused during the winter months in the vicinity of cooling ponds. (See also W81-01381) (Seigler-IPA)
W81-01386

3D. Conservation In Domestic and Municipal Use

MONO LAKE, CALIFORNIA: SAVING A LAKE OR SERVING A CITY,
Wisconsin Univ.-Madison. Dept. of Geography.
T. R. Vale.
Environmental Conservation, Vol 7, No 3, p 190-192, Autumn, 1980. 2 Fig, 1 Tab, 13 Ref.

Descriptors: *Water utilization, *Los Angeles aqueduct, *Water conservation, Lakes, Irrigation, Potable water, Environmental effects, Aqueducts, Migratory birds, Waterfowl, Aquatic life, Water demand, Water resources development, Surface water availability, Saline lakes, Water quality.

Completion of the Los Angeles Aqueduct in 1913 caused the level of the Mono Lake waters since then to drop by about 15 meters. The surface area of the lake has decreased by nearly 50%, and an island in the lake which supports nesting California gulls has connected with the mainland, exposing the colony to predation. Los Angeles officials insist that the present water use rate from the aqueduct is necessary to serve the domestic needs of the residents of the city. Environmentalists fear that decreased water levels will cause fluctuations in lake populations of brine shrimp and brine flies, which form an important part of the diet of migratory and nesting birds of the Mono Lake area. Several environmental groups have endorsed plans to reduce water exports from the lake to 18 million cubic meters per year. This would constitute a reduction of 110 million cubic meters of water per year, or 14% of the water supply now consumed by the 3 million residents of Los Angeles. Much more water is used for agricultural irrigation than for domestic purposes. Recent studies have shown that water demand often depends on water availability, and voluntary practices of water conservation by Southern California residents have yielded decreases in water consumption greater than that which would have resulted from imposed rationing. Discussions on the more efficient use of urban water supplies are included. (Geiger-FRC)
W81-01255

WATER AND ENERGY CONSERVATION ALTERNATIVES FOR THE NORTH,
Environmental Protection Service, Edmonton (Alberta).
J. J. Cameron, and B. C. Armstrong.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 47-88. 5 Fig, 10 Tab, 32 Ref.

Descriptors: *Northwestern Territories, *Canada, *Cold regions, *Water conservation, Public health, Education, Toilets, Showers, Bathing, Hot water, Plumbing, Economic efficiency, Water demand, Water consumption, Water reuse.

A comprehensive study conducted by the Government of the Northwestern Territories shows that water use can be significantly reduced by public education. Prudent application and acceptance of water conservation methods can improve the level of service and sanitation in northern areas more rapidly than earlier thought possible. Extensive tables and discussion are given on toilet modification alternatives, toilet alternatives, bathing alternatives, laundry alternatives, and miscellaneous water conservation alternatives. Toilets use more water than any other home fixture. The economics of various water conservation devices is determined by the reduction in water demand and energy costs for hot water heating. An analysis of a four-person household recommends a dual flush and dam toilet, low flow shower heads, front load washers, and insulated hot water pipes. Recommendations vary according to the type of water supply system used, either a piped system or a trucked system. Since the cost of trucked service is directly related to water consumption, a reduction in demand will change the economic attractiveness of such trucked systems. (See also W81-01381) (Seigler-IPA)
W81-01384

3F. Conservation In Agriculture

YIELD RESPONSE OF CORN RELATED TO SOIL MOISTURE,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
R. V. Morey, J. R. Gilley, F. G. Bergsrud, and L. R. Dirkzwager.
Transactions of the ASAE, Vol 23, No 5, p 1165-1170, October/November, 1980. 3 Fig, 6 Tab, 12 Ref.

Descriptors: *Corn, *Crop response, *Irrigation practices, Soil moisture, Soil-water-plant relationships.

The response of corn to sprinkler irrigation was studied for 3 seasons, 1973-1975, on a Hubbard loamy sand at Elk River, Minnesota. The 4 treatments in 1973 were scheduled on a moisture depletion basis as follows: no irrigation, and irrigation when soil moisture dropped to 25%, 50%, and 75%. The irrigated crop yield was about twice the nonirrigated crop yield, but there was little variation in results among the 3 irrigation treatments. The 1974 and 1975 treatments were based on fixed intervals and amounts of water. Corn yield was poor in the nonirrigated treatment and was greater with increasing amounts of water applied. Gravimetric soil moisture measurements were used to further validate a soil moisture budget model. Computed and measured moisture contents agreed well. This model provided estimates of transpiration ratio and yield response functions. (Cassar-FRC)
W81-01274

CROP WATER SUPPLIED BY CONTROLLED AND REVERSIBLE DRAINAGE,
Science and Education Administration, Florence, SC. Coastal Plains Soil and Water Conservation Research Center.
For primary bibliographic entry see Field 2D.
W81-01277

MULTIPLE CHAMBER DRIP IRRIGATION HOSE,
W. A. Delmer.
U.S. Patent No 4,196,853, 8 p, 14 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 2, p 507, April 8, 1980.

Descriptors: *Patents, *Irrigation, *Application equipment, Irrigation efficiency, Irrigation practices, Irrigation operation and maintenance, *Drip irrigation.

A multiple chamber drip irrigation hose has a primary and at least one secondary tube of flexible, water-impermeable material and is joined at a common wall. The common wall has a series of first holes placing the interior of the primary tube in communication with the interior of the secondary tube. The secondary tube has a series of second holes leading from the interior of the secondary tube to the exterior. A flexible filamentary line, ridge or groove is positioned within the secondary tube and forms a restricted path for water flowing from a first hole to a second hole. The apparatus compensates for varying pressures in the water supply and will automatically flush or blow out each time the water is turned on. (Sinha-OEIS)
W81-01417

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

TEMPORARY DETENTION CUTS STORM FLOW PEAKS,
Metropolitan Sanitary District of Greater Chicago, IL.
A. Talhami.
Civil Engineering-ASCE, Vol 50, No 12, p 72-75, December, 1980.

Descriptors: *Storm runoff, *Storm drains, *Urban hydrology, Storm sewers, Water storage, Urban runoff, Weirs, Cities, Stormflow, Sewers, Intakes, Pipes, Detention reservoirs, Pondage, Storage.

Methods of providing on-site temporary detention of stormwater runoff are discussed. These are useful in the design of urban drainage systems, for reducing peak rates of discharge from storm sewers. All designs are based on inflow in excess of outflow. They are sited upstream from any physical constraints such as culverts, and have a peak discharge which is limited by the hydraulic capacity of the constraints. Methods include detention basins, ponds, detention lakes, parking lots, underground structures, roof storage, crushed stone beds and surface storage in open spaces. Controlled release rates can be achieved by designing pipes with smaller diameters and by installing roof restrictors, weirs, and outlet structures in the middle of ponds. Such detention facilities are gaining increased acceptance as flood control measures. (Titus-FRC)
W81-01254

HYDROLOGIC INVESTIGATION, DESIGN, AND CONSTRUCTION OF FLOOD CONTROL STRUCTURES, COPPERHILL, TENNESSEE,
Dames and Moore, Denver, CO.
U. Kappus, C. L. Zimmerman, and T. Turner.
Mining Engineering, Vol 32, No 10, p 1504-1509, October, 1980. 6 Fig, 1 Tab, 14 Ref.

Descriptors: *Dam design, *Flood control, *Safety, Construction, Diversion, Hydrograph analysis, Conduits, Mining, Tennessee.

A project is described which was designed to divert flood flows of the North Potato Creek from the Cherokee ore body (Copperhill, Tennessee). Hydrologic studies were performed, and hydrographs were developed for possible floods. Computer simulations were performed for required dam height and overflow tunnel diameter. The project consisted of: a 28 m dam and a 9 m outlet conduit, an emergency spillway, and a 4 m diameter hard rock transbasin diversion tunnel. Design studies consisted of: site conditions, laboratory testing of soils and rock, embankment design, internal drainage, outlet conduit, and emergency spillway. Construction of the project is described. The flood management system is part of the Cities Service Co. mine safety program for the Cherokee ore body, which is particully located within the creek channel. (Small-FRC)
W81-01301

WATERCOURSE IMPROVEMENT STRATEGIES FOR PAKISTAN,
Colorado State Univ., Fort Collins.
J. O. Reuss, G. V. Skogerboe, and D. J. Merrey.
Water Supply and Management, Vol 4, No 5/6, p 409-422, 1980. 2 Fig, 2 Tab, 21 Ref.

Descriptors: *Water conveyance, *Water policy, *Pakistan, Water management, Water loss, Irrigation canals, Water conservation, Estimated costs, Planning, Water institutions, Watercourse improvement.

Losses of water from Pakistan's more than 80,000 watercourses reach at least 35-45%. Seepage and visible leaks from unimproved channels are a

major source of these losses. A combination of three major strategies for improvement is recommended. The cheapest method, at a cost of 33 rupees per acre foot and minimum investment, is heavy cleaning and maintenance, which involves removal of excessive vegetation and rebuilding banks. A second strategy entails lining channels with brick and mortar in areas of heavy traffic and water loss. Cost estimates are 70 rupees per acre foot. The third method, completely and properly lined channels, can save 95% of water losses at a cost of 124 rupees per acre foot and a large initial investment. These three methods may be used in combination, considering that the value of water saved in each locale determines the logical conservation method. The authors favor a decentralized administrative organization with local farmers participating in decisions and construction programs. A possible practical approach for reducing water losses in Pakistan courses would be immediate wide-scale implementation of the cleaning and maintenance strategy and formation of local Water Users Associations. More extensive improvements should be made where water costs and benefits justify them. (Cassar-FRC)
W81-01334

AQUATIC WEED CUTTER,
E. R. Donnelley.
U.S. Patent No 4,196,566, 8 p, 14 Fig, 15 Ref; Official Gazette of the United States Patent Office, Vol 993, No 2, p 410, April 8, 1980.

Descriptors: *Patents, *Water control, *Aquatic weeds, *Aquatic weeds, *Aquatic weed control, Equipment, Channels, Channel improvement, Weed cutter.

An aquatic weed cutter for cutting aquatic plants and root systems includes a water vehicle having a drive system connected to at least two shafts that project out of the vehicle. Each shaft has a circular cutting blade mounted at the distal end of the shaft. The cutting blades are positioned for rotation in a generally vertical plane for cutting as well as for propelling the vehicle through the water. The drive system is also used to control the position of the shafts below the surface of the water in order to position the tips of the cutting blades at various distances below as well as above the surface of the water bed. The shafts are positioned from one another in order to provide an overlapping relationship between each cutting blade. A forward cleaning blade is placed forward of each of the cutting blades with teeth having leading and trailing pitched portions to keep the cutting blades clean of debris. (Sinha-OEIS)
W81-01416

4B. Groundwater Management

INDIGENOUS RESOURCES AND WATER SUPPLY MANAGEMENT,
International Labour Organization, Geneva (Switzerland). Employment and Development Dept.
M. I. Hussain.
Water Supply and Management, Vol 4, No 4, p 201-219, 1980. 1 Fig, 6 Tab, 28 Ref.

Descriptors: *Irrigation programs, *Employment, *Water supply development, *Egypt, Manpower, Labor, Future planning, Water resources development, Water management, Equipment, Irrigation design, Crop production.

Arguments are presented which support the contention that provisions of irrigation increase job opportunities by expanding agricultural potentials and by utilizing manpower to work on irrigation system construction and maintenance. Irrigation has been shown to affect labor use by increasing cropping intensity, allowing shifts in crop patterns, and encouraging farmers to use high yield varieties. The work generating processes involved in preparing land for successful irrigation include leveling of land, digging of irrigation channels, and building of drainage systems. Each process is discussed with emphasis on its implementation in Egypt, along with manpower labor requirements. Small scale irrigation projects can generally be performed by unskilled laborers with locally manufactured equipment. Some small scale surface water and groundwater projects are discussed in relation to their ability to provide irrigation water and generate jobs. Although small scale projects are useful in serving immediate needs, they are often accused of being unreliable and of low quality, and of using inferior materials. The large-scale irrigation projects play an integral part in the economic growth of a nation. They are long term affairs employing more skilled employees, better technologies and more durable materials and equipment. To aid in deciding which type of labor intensive technology would be appropriate for developing countries, the World Employment Program has initiated a 'Development and application of appropriate technology for irrigation works' program. (Geiger-FRC)
W81-01329

DETERMINING IMPACT OF IRRIGATION ON GROUNDWATER,
Youngstown State Univ., OH. Dept. of Civil Engineering.
I. A. Khan.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 106, No IR 4, p 331-334, December, 1980. 9 Fig, 2 Tab, 23 Ref.

Descriptors: *Irrigation practices, *Agricultural engineering, *Environmental effects, Soil-water-plant relationships, Irrigation engineering, *Groundwater, Mathematical models, Groundwater resources, Irrigation systems, Arable land, Irrigation effects, Irrigable land, Water injury, Irrigation, Subsurface waters, Percolating water, Water table, Water quality.

Irrigation may adversely modify the soil and groundwater for the growth of most crops and eventually lead to the destruction of the irrigated system. However, careful planning and management may delay destruction. Salination is one symptom of potential destruction. A modeling procedure is described which inexpensively predicts groundwater quality as a result of present and future irrigation and agricultural practices. Specifically, the model predicts ionic distribution of irrigation return flows. It determines the effect of varying the leaching fraction on the quality of return flows and the effects of pumping and irrigation application schemes on the quality and quantity of groundwater. In addition, it predicts the effect of land use and cropping pattern changes on groundwater quantity and quality. (Titus-FRC)
W81-01370

4C. Effects On Water Of Man's Non-Water Activities

CHARACTERIZATION OF STORM RUNOFF IN LAS VEGAS VALLEY, NEVADA,
Nevada Univ. System, Reno. Water Resources Center.
J. W. Hess, and D. E. Zimmerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156663, Price codes: A04 in paper copy, A01 in microfiche. Publication No 41067, 1980. 57 p, 8 Fig, 6 Tab, 8 Ref. 5 Append. OWRT-A-084-NEV(1), 14-34-0001-8030.

Descriptors: *Storm runoff, *Salinity, *Urbanization, *Water quality, *Dissolved solids, Runoff, Rainfall intensity, Flash floods, Floods, Arid climates, Topography, Data collections, Las Vegas Valley basin(NV), Las Vegas(NV), *Nevada.

The total salinity of storm runoff is an important consideration. Public law 93-320 entitled the 'Colorado River Basin Salinity Control Act' has designated several sites, including Las Vegas Wash, for salinity control measures. A potentially significant salt load source is storm runoff. The purpose of this research was to develop background data on the chemical characteristics of storm runoff in Flamingo Wash, Las Vegas Valley. Seven runoff events were sampled at four sites along Flamingo Wash during the period of October 1977 through October 1978. Precipitation occurs from two types of events, both of which will produce runoff. Winter frontal storms produce large areas of low intensity rainfall, but can produce large totals. Summer precipitation results generally with precipitation amounts greater than 0.25mm with about 37% of these events being greater than 6.25mm. Approximately 15 thundershowers per year occur in the valley. Storm runoff from Flamingo Wash is apparently not an important source of salt loading to the Colorado system. In general, observed TDS during runoff events was less than 1000 mg/l.
W81-01205

REVIEW AND EVALUATION OF URBAN FLOOD FLOW FREQUENCY PROCEDURES,
Science and Education Administration, Beltsville, MD. Hydrology Lab.
W. J. Rawls, V. Stricker, and K. Wilson.
Bibliographies and Literature of Agriculture No 9, August, 1980. 65 p, 3 Tab, 1 Append.

Descriptors: *Flood flow, *Flood frequency, *Urbanization, *Model studies, Storm runoff, Urban runoff, Watersheds(Basins), Statistical models, Urban hydrology, Surface runoff, Rational formula, Mathematical studies, Urban drainage, Floods, Precipitation(Atmospheric).

Man's impact through urbanization causes a dramatic effect on the flood response of a watershed. Usually, the introduction of impervious surfaces and improved drainage systems increases the amount of runoff and reduces flow travel times, producing a flood hydrograph of increased magnitude that is quicker to rise and recede. This report evaluates 128 published and unpublished papers (1962 to 1979) on urban flood flow frequency estimation procedures. The procedures are separated into three classes: statistical estimation of peak flow, single storm event, and continuous record. The literature does not adequately reflect what procedures are currently being used, but instead contains many articles on experimental models that have been designed for a specific region or a specific problem. Also, many of the single event and continuous record models reported were modified versions of previously reported models. Most of the models in the single event and continuous record categories could be applied regionally or nationally; however, no models in the statistical estimation of peak flow category, except perhaps the rational formula, had regional or national applicability. (Moore-SRC)
W81-01221

4D. Watershed Protection

EROSION BY CIRCULAR WALL JETS IN CROSS FLOW,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnam.
Journal of the Hydraulics Division Proceedings of the American Society of Civil Engineers, Vol 106, No 11, p 1867-1883, November, 1980. 12 Fig, 1 Tab, 15 Ref.

Descriptors: *Erosion rates, *Waste water disposal, Laboratory tests, *Turbulent flow, Effulents, Scour, Flow, Nozzles, Rivers.

The erosion caused by circular turbulent wall jets used to discharge effluents into rivers was examined. One jet with a diameter of 0.50 inch (12.7 mm) was evaluated in a wind tunnel using three weights of sand and one of polystyrene. A water-sand system was evaluated in the hydraulics laboratory using a 0.5 inch (12.7 mm) nozzle and sand. Equations are derived to estimate erosion under various conditions. A strong interaction was found between jet and cross flow. The maximum erosion was located nearer to the nozzle when there was cross flow. The profile of the eroded bed was similar if analyzed separately for the scour hole and ridge regions. (Small-FRC)
W81-01350

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

BACTERIOLOGICAL AND NUTRIENT STUDY OF MAJOR SURFACE WATERS IN BANFF NATIONAL PARK.
Inland Waters Directorate, Ottawa (Ontario).
Technical Report WQB-79-5, December, 1979. 60 p, 9 Fig, 13 Tab, 6 Ref, 1 Append.

Descriptors: *Surface waters, *National parks, *Water quality, *Canada, *Nutrients, *Aquatic microorganisms, Aquatic life, Recreation facilities, Natural resources, Facilities, Recreation, Water pollution, Water pollution sources, Lakes, Lagoons, Microorganisms, Analysis, Testing, Evaluation, Water analysis, Bacteria, Coliforms, *Banff National Park(Alberta).

The quality of surface waters in Banff National Park, located about 112 km west of Calgary in the eastern ranges of the Rocky Mountains, was studied in 1975 and 1976. The study documents the existing quality of a number of surface waters within the Park, and indicates that the quality of the Bow River, Louise Creek, Sunshine Creek, Forty Mile Creek, and the Spray River are degraded by human activities. Effluent releases from lagoons at Lake Louise and Banff were found to increase nutrient levels and bacteria populations in the Bow River. Louise Creek quality is impaired by effluent releases from the upper sewage lagoon and by discharge from the Chateau Lake Louise heating plant. Forth Mile Creek quality was adversely affected by effluent releases from the septic system serving the Banff Recreation Center. Septic wastes are now directed to the Banff townsite sewage system. Bacteriological counts showed that fecal material intermittently enters the low reaches of the Spray River from an unidentified source. Bow Lake and Lake Minnewanka had good quality with no apparent effect from lake shoreline development. Salmonella and Shigella pathogenic bacteria were absent in all study samples tested. (Zielinski-IPA)
W81-01212

SURFACE WATER QUALITY IN YOHO NATIONAL PARK - AN INVENTORY.
Inland Waters Directorate, Ottawa (Ontario).
Technical Report WQB-80-1, January, 1980. 24 p, 1 Fig, 5 Tab, 14 Ref, 1 Append.

Descriptors: *Surface waters, *Water quality, *Canada, *National parks, Anions, Cations, Aquatic microorganisms, Aquatic life, Facilities, Recreation facilities, Natural resources, Recreation, Water analysis, Ions, Electrolytes, Properties, Trace metals, Heavy metals, Water pollution, Microorganisms, Chemical analysis, Evaluation, Nutrients, *Yoho National Park(British Columbia).

The results of a two-year baseline monitoring program carried out in Yoho National Park, located in the heart of the Canadian Rockies, are presented and summarized. The study, which covered the period from April 1976 to March 1978, showed that while the Park waters are generally of good quality, Park areas exist where surface water quality has been degraded by human activites. Nutrient levels in all surface waters examined were typically low and did not appear to be elevated by activities within the Park. In decreasing abundances, the major cations were calcium, magnesium, sodium, and potassium; while the major anions were bicarbonate, sulfate, silicates, chlorides, and fluorides. The abundance of these ions were similar to those found in most Rocky Mountain Parks. Copper, cadmium, mercury, arsenic, selenium, lead, and barium were generally below/near detection limits in all streams. Measurable manganese, iron, and boron levels present in most waters studied were highest during the high water period, suggesting significant concentrations of these in the suspended sediments. Most Park surface waters were found to be of natural bacteriological quality; however, several locations of high total coliforms were noted. (Zielinski-IPA)
W81-01213

A SIMPLE METHOD USING A DISPOSABLE SYRINGE TO PREPARE SAMPLES FOR DELTA 018 MEASUREMENTS IN WATER SAMPLES,
Centro de Energia Nuclear na Agricultura, Sao Paulo (Brazil).
E. Matsui.
Analytica Chimica Acta, Vol 120, p 423-425, November, 1980.

Descriptors: *Oxygen isotopes, *Isotope studies, Syringes, Water analysis, Analytical techniques.

Commerical 10 ml disposable polypropylene syringes may be used for isotopic equilibration in delta 018 determinations in water samples. The procedure involves adding concentrated H2SO4 without contaminating the upper internal surface of the syringe, placing the piston in the cylinder without touching the acid, and pulling the sample of water into the cylinder. After the sample is shaken, the water volume is adjusted to 3.0 ml, CO2 is inserted to 10 ml, and the syringes placed in a heated water bath overnight. One technician can prepare 50 samples in 2 hours. (Cassar-FRC)
W81-01241

DETERMINATION OF TRACE AMOUNTS OF ALKYLBENZENE-SULFONATES BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY WITH FLUORIMETRIC DETECTION,
Kao Soap Co. Ltd. Tochigi (Japan).
A. Nakae, K. Tsuji, and M. Yamanaka.
Analytical Chemistry, Vol 52, No 14, p 2275-2277, December, 1980. 2 Fig, 4 Tab, 14 Ref.

Descriptors: *Alkylbenzene sulfonates, *Analytical techniques, Pollutant identification, Detergents, Gas chromatography, Water analysis.

Modifications in the high performance liquid chromatography method of determining trace amounts of alkylbenzene sulfonates in water produced improved analytical results. No preconcentration or derivatization was necessary. Use of 0.1 M sodium perchlorate in methanol/water (8:2) optimized operating conditions of the fluorimeter used to detect the components. Alkylbenzene sulfonates were well resolved according to alkyl chain lengths. Partial phenyl isomer compositions were also obtained. River water analysis by this modified method was reproducible within 2% relative standard deviation in the range of 0.097 micrograms per ml. (Cassar-FRC)
W81-01242

POLY(ACRYLAMIDOXIME) RESIN FOR DETERMINATION OF TRACE METALS IN NATURAL WATERS,
Massachusetts Univ., Amherst. Dept. of Chemistry.
M. B. Colella, S. Siggia, and R. M. Barnes.
Analytical Chemistry, Vol 52, No 14, p 2347-2350, December, 1980. 4 Tab, 30 Ref.

Descriptors: *Resins, *Analytical techniques, *Metals, Pollutant identification, Poly(acrylamidoxime), *Trace elements, Sea water, Ponds, Spectrometry.

Trace metal determinations in natural waters are important in pollutant identification and in cases of micronutrient depletion. Application of a poly(acrylamidoxime) resin to the determination of Fe(3+), Mn(2+), Cu(2+), Zn(2+), Co(2+), Ni(2+), Hg(2+), Pb(2+), Cd(2+), and Ag(1+) in sea water and pond water showed good agreement with values determined by differential pulse polarography or differential pulse anodic stripping voltammetry. Metals were removed from the resin by equilibrating with a 1:1 nitric acid/water mixture, a 1:1 HCl/water mixture, or a 1M thiosulfate solution. Concentrations of metals in the eluate were determined by atomic absorption spectrometry. This resin has several advantages over previously used materials. The alkali and alkaline earth metals in sea water do not interfere with analysis. Simple elution removes sequestered metals, allowing regeneration of the resin for subsequent analysis. (Cassar-FRC)
W81-01243

IDENTIFICATION OF CHLORINATED METHOXYBIPHENYLS AS CONTAMINANTS IN FISH AND AS POTENTIAL INTERFERENCES IN THE DETERMINATION OF CHLORINATED DIBENZO-P-DIOXINS,
Food and Drug Administration, Washington, DC. Div. of Chemical Technology.
D. W. Phillipson, and B. J. Puma.
Analytical Chemistry, Vol 52, No 14, p 2328-2332, December, 1980. 6 Fig, 1 Tab, 21 Ref.

Descriptors: *Polychlorinated biphenyls, *Pollutant identification, *Analytical techniques, Chlorinated hydrocarbon pesticides, Mass spectroscopy, Gas chromatography, Chemical analysis, Organic compounds, Dioxins, Fish.

Chlorinated methoxybiphenyls interfered with determination of polychlorinated dibenzo-p-dioxins in fish samples examined by gas-liquid chromatography/mass spectroscopy. Synthesized 3,3',4',5-tetrachloro-4-methoxy biphenyl and 2,3',4,4'-tetrachloro-3-methoxybiphenyl behaved similarly to the dioxins in cleanup procedures and in gas-liquid chromatography/mass spectroscopy properties. It is suggested that previous analytical results obtained on environmental samples be reexamined by selected ion monitoring exclusively for the isotopic molecular ions from dioxins. For reliable identification and quantification of polychlorinated dibenzodioxins, it might be necessary to examine the mass spectra to rule out the presence of polychlorinated methoxy biphenyls (by the absence of fragment ion clusters resulting from losses of CH3, CH3CO, and CH3CO + 2Cl from the M+ cluster). (Cassar-FRC)
W81-01245

***MASS SPECTROMETRIC DETERMINATION* OF DEUTERIUM IN WATER AT NATURAL LEVELS,**
Australian Atomic Energy Commission Research Establishment, Lucas Heights.
P. E. Hartley.
Analytical Chemistry, Vol 52, No 13, p 2232-2234, November, 1980. 2 Fig, 2 Tab, 6 Ref.

Descriptors: *Mass spectromety, *Deuterium, *Water analysis, Isotope studies, Hydrologic data, Performance, Chemical analysis, Australia.

A new system for measuring the D/H ratio of natural water samples for hydrological investigations is described, and sample measurement data are provided. The system is based on an AEI MS20, a small 180 deg deflection machine. Improvements in furnace design and a memory correction technique have eliminated the necessity to introduce samples more than once except after large changes in D/H between samples. One hundred samples can be measured to an accuracy of 0.1% with 95% confidence in an 8-hour day. The system is being used in various hydrological investigations by the Australian Atmic Energy Commission Nuclear Hydrology Group. (Small-FRC)
W81-01246

***PROFICIENCY TEST* SAMPLE MEDIA FOR SINGLE AND MIXED PURE CULTURES OF WATER POLLUTION INDICATOR BACTERIA,**
New York State Dept. of Health, Albany.
R. W. Toombs, and D. A. Connor.
Applied and Environmental Microbiology, Vol 40, No 5, p 883-887, Novermber, 1980.

Descriptors: *Water analysis, *Quality control, *Bioindicators, *Separation techniques, On-site tests Analytical techniques, Pollutant identification, Coliforms, Cultures, Isolation, Enteric bacteria, Pseudomonas, Sampling, Storage, Potable water, Testing procedures, Water pollution.

Tests were conducted to find a suitable transport medium for culturing bacteria from water samples that would maintain Escherichia coli, Enterobacter cloacae and Pseudomonas aeruginosa in combination for 48 hours to provide a positive coliform count and a countable standard plate. Two media, designated NYSDH-1 and NYSDH-2, were formulated which required no special handling or reconstitution and maintained inoculated organisms with an 88% viability level for up to 48 hours. Sample preparation procedures and shipping and handling protocol were also devised for use with the new media. The stability of E. coli and P. aeruginosa in NYSDH-1 media and E. cloacae in NYSDH-2 media were investigated in pilot studies designed to simulate field conditions for analysis of potable water for coliforms by membrane filter and standard plate count and most probable number dilution tests. Actual field tests were conducted on a reference set of samples which was shipped to and analyzed by laboratories at the Environmental Protection Agency or in New York State. Statistical analyses of results showed that the media are satisfactory for use in laboratory quality control programs. (Geiger-FRC)
W81-01249

ORGANOCHLORINE COMPOUNDS IN AQUATIC ENVIRONMENTS,
Labor Inspection Directorate, Oslo (Norway).
J. E. Bjerk, and E. M. Brevik.
Archives of Environmental Contamination and Toxicology, Vol 9, No 6, p 743-750, 1980. 2 Tab, 10 Ref.

Descriptors: *Aquatic life, *Chlorinated hydrocarbon pesticides, Pentachlorobenzene, Octachlorostyrene, Hexachlorobenzene, Pesticide residues, Agricultural chemicals, Invertebrates, Fish, Polychlorinated biphenyls, Pollutants, Sediments, Path of pollutants, Absorption, *Norway, *Oslo Fjord area(Norway).

Body burdens of five organochlorine compounds were examined at two locations in the Oslo Fjord area of Norway in the following species: barnacles, bristle worm, brittle star, cod, common goby, crab, flounder, hermit crab, mussel, saithe, sea star, shrimp, and snail. Uniform levels of contamination were found for DDE, PCBs, and pentachlorobenzene, especially when data were compared on a fat weight basis. Hexachlorobenzene and octachlorostyrene were found at various levels of concentration in the different species. The ratio of PCB/DDE was constant at 10 among the invertebrates, and close to 15 for fish species. PCB levels ranged from 1.5 times the dry sediment level in mussel to 8.5 for flounder, giving an interspecific variation factor of 5.4. The corresponding factor for DDE was 4.6. Sedimentary contamination was minimal for HCB and DDE. The findings concerning DDE, PCBs and pentachlorobenzene suggest that direct uptake from water via respiratory organs occurs as a result of direct body contact with the contaminants, and makes this the major route of entry. Variable levels of HCB and octachlorostyrene are not explained by this theory. High residue levels in some species seem to result from feeding habits, even though it has been definitely demonstrated that accumulation through food chains occurs. (Baker-FRC)
W81-01250

SIMPLIFIED MONITORING PROCEDURE FOR BENZO(A)PYRENE, HEXACHLOROBENZENE AND PENTACHLOROPHENOL IN WATER,
Texas A and M Univ., College Station. Dept. of Chemistry.
C. S. Giam, D. A. Trujillo, S. Kira, and Y. Hrung.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 5, p 824-827, November, 1980. 2 Tab, 4 Ref.

Descriptors: *Analytical techniques, *Pollutant identification, *Organic chemicals, Water analysis, Chromatography, Insecticides, Fungicides, Herbicides, Pentachlorophenol, Hexachlorobenzene, Benzo(a)pyrene, Polycyclic hydrocarbons, Carcinogens, Agricultural chemicals.

Simplified methods of water analysis are reported which require only a 5.0 ml sample to measure concentrations of pollutants ranging from 0.2 to 220 ppb. The methods are useful for analysis of benzo(a)pyrene (BaP), hexachlorobenzene (HCB) and pentachlorophenol (PCP) as well as similar contaminants in water. For analysis of BaP, samples were twice extracted with petroleum ether and the extracts combined. Solvent was next evaporated with a slow stream of dry nitrogen filtered through a molecular sieve. The residue was dissolved in MeOH, and 50-100 upsilon l were analyzed by high pressure liquid chromatography (HPLC). BaP concentrations of 0.04 to 2.0 ppb were recovered with 80% or better accuracy. Samples containing HCB were extracted once with isooctane and the extract directly analyzed by gas chromatography with an electron capture detector. HCB concentrations of 0.5 ppb gave recoveries greater than 75%. Samples containing PCP were acidified with sulfuric acid and then extracted twice with petroleum ether/diethyl ether. Solvent was evaporated from the combined extracts by dry nitrogen as above. Residue was dissolved in acrylonitrile and analyzed by HPLC. PCP concentrations ranging from 80 to 200 ppb gave greater than 80% recoveries. (Baker-FRC)
W81-01251

FIELD AND LABORATORY METHODS FOR INVESTIGATING A MARINE GASOLINE SPILL,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
C. W. Dimock, J. L. Lake, C. B. Norwood, R. D. Bowen, and E. J. Hoffman.
Environmental Science and Technology, Vol 14, No 12, p 1472-1475, December, 1980. 2 Fig, 1 Tab, 20 Ref.

Descriptors: *Pollutant identification, *Gasoline, Chromatography, Mass spectrometry, Analytical techniques, Water pollution, Organic compounds.

A method for examining somewhat volatile hydrocarbon pollutants in water samples is described, which uses on-board liquid-liquid extraction followed by transfer of extracts to the laboratory and analysis by gas chromatography and gas chromatography-mass spectrometry. The method was used to measure gasoline compounds in seawater samples collected during the response to a spill situation. Samples were collected both of water and of bivalve mollusks near Block Island Sound, Rhode Island. The results of the analysis indicated that almost all of the gasoline compounds present in the water samples could be detected by this method. A portion of each of these individual compounds was, however, lost during sample handling and analysis. Recovery of gasoline compounds in spiked seawater samples was consistent and ranged from 50 to 70%. Gas chromatograms of extracts from most of the shellfish tissues showed some resemblance to those obtained from gasoline standards, but interfering peaks were also prominent. The analytical methodology used here could be successfully applied to a spill situation where no observable gasoline slick was present. If a slick were present the sampling bottle would probably be contaminated and the analysis biased. (Baker-FRC)
W81-01260

ANALYTICAL ISSUES IN COMPLIANCE MONITORING,
For primary bibliographic entry see Field 7A.
W81-01261

APPLICATIONS OF LANDSAT DATA FOR ESTIMATING PHYTOPLANKTON PRODUCTION IN LAKE CHAD (AFRICA). (APPLICATION DES DONNEES LANDSAT A L'ESTIMATION DE LA PRODUCTION DU PHYTOPLANCTON DANS LE LAC TCHAD),
Institut National de la Recherche Agronomique, Thonon-les-Bains (France).
For primary bibliographic entry see Field 2H.
W81-01262

ISOLATION OF 01 SERVOVARS OF VIBRIO CHOLERAE FROM WATER BY SEROLOGICALLY SPECIFIC METHOD,
Louisiana State Univ., Baton Rouge. Dept. of Microbiology.
K. W. Hranitzky, A. D. Larson, D. W. Ragsdale, and R. J. Siebeling.
Science, Vol 210, No 4473, p 1025-1026, November, 1980. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Separation techniques, *Pathogenic bacteria, *Louisiana, Water pollution, Public health, Human diseases, Water pollution effects, Aquatic bacteria, Adsorption, Water analysis, Laboratory tests, Pollutant identification, Assays, Path of pollutants, Bayous, Cholera.

Eleven cases of cholera occurred among Louisiana residents in 1978 and were traced to contaminated food containing the Vibrio cholerae bacteria of the serological variety 01. Cholera is generally transmitted by food, water or fomites polluted with human feces containing the bacteria. It became important to discern whether the 01 serovar responsible for the Louisiana cholera cases was imported from an endemic area by an infected person, or whether the bacterium was present in Louisiana as part of the normal aquatic flora. A method which combines the principles of serologically specific electron microscopy and enzyme-linked immunosorbent assay was used to isolate 01 serovars of V. cholerae from environmental water samples. The water was mixed with Tween 20 and passed through packed columns of polystyrene beads. The beads, which were coated with antibodies against the 01 antigenic determinants, were then washed with buffer and Tween 20, transferred to alkaline peptone broth, and incubated. Growth on the broth was transferred to selective medium on petri plates, and V. cholerae colonies were isolated and identified by routine microbiological procedures. Water samples taken from a south central Louisiana bayou showed the presence of 01 serovars of V. cholerae by this isolation technique. The method is also recommended for isolating Salmonella, Shigella and Legionella from water or other potentially pathological specimens. (Geiger-FRC)
W81-01282

A NOTE ON THE SENSITIVITY OF CHLORINE-STRESSED BIFIDOBACTERIA TO NALIDIXIC ACID,
Department of Water Affairs, Pretoria (South Africa). Hydrological Research Inst.
D. P. Sartory.
Journal of Applied Bacteriology, Vol 49, No 2, p 291-293, October, 1980. 1 Tab, 8 Ref.

Descriptors: *Bacteria, *Sewage effluents, Bifidobacteria, Nalidixic acid, Chlorine, Pollutant identification, Bioindicators, *Chlorination, Evaluation.

Bifidobacterium adolescentis, an indicator of fecal pollution, was proved sensitive to 10 micrograms per ml nalidixic acid after exposure to chlorinated sewage effluent containing 0.08 mg per 1,000 ml residual chlorine. Effluent containing 0.7 mg per 1,000 ml chlorine caused sensitivity at the level of 5 micrograms per ml of nalidixic acid. Normally, B. adolescentis is resistant to 200 micrograms per ml nalidixic acid. It was concluded that the Evison-Morgan medium (5 micrograms nalidixic acid per ml) would give a valid bacteria count from effluent containing less than 0.1 mg per 1,000 ml residual chlorine. The Resnick-Levin YN-6 medium (80 micrograms nalidixic acid per ml) may give rise to or a very low count of bacteria in chlorinated effluent. (Cassar-FRC)
W81-01290

IDENTIFICATION OF HAZARDOUS ORGANIC CHEMICALS IN FISH FROM THE ASHTABULA RIVER, OHIO, AND WABASH RIVER, INDIANA,
Environmental Research Lab., Duluth, MN.
D. W. Kuehl, E. N. Leonard, K. J. Welch, and G. D. Veith.
Journal of the Association of Official Analytical Chemists, Vol 63, No 6, p 1238-1244, 1980. 3 Fig, 3 Tab, 10 Ref.

Descriptors: *Pesticide residues, *Fish, *Pollutants, Water pollution, *Pollutant identification, Ashtabula River(OH), Wabash River(IN), DDT, Polychlorinated biphenyls, Endrin, Heptachlor, Arochlors, Organic compounds.

Composite fish samples from the Wabash River, Indiana, and the Ashtabula River, Ohio, were analyzed for pesticide residues by gas chromatography/mass spectroscopy using both electron impact and negative chemical ionization modes. The Wabash River fish sample contained 310 ppb DDT, 3210 ppb total polychlorinated biphenyls, 30 ppb hexachlorobenzene, 8.54 ppb trans-chlordane, 12.98 ppb cis-chlordane, 20.04 ppb trans-nonachlor, 4.89 ppb cis-nonachlor, and less than 0.50 ppb heptachlor, heptachlor epoxide, oxychlordane, and octachlorostyrene. Endrin, some of its manufacturing intermediates, and some metabolites were also found. Pentachlorophenol, a wood preservative, and pentachlorobenzyl alcohol were present. The Ashtabula River sample contained 130 ppb DDT, 7200 ppb PCB's, 3140 ppb hexachlorobenzene (the second highest level observed in previous work), 500 ppb octachlorostyrene, and less than 0.50 ppb of the chlordanes, nonachlors, and heptachlors. This sample also contained a number of polychlorinated hydrocarbons with 2-6 carbons. (Cassar-FRC)
W81-01292

GAS CHROMATOGRAPHIC DETERMINATION OF FLURIDONE AQUATIC HERBICIDE AND ITS MAJOR METABOLITE IN FISH,
Lilly Research Labs., Greenfield, IN. Agricultural Analytical Chemistry.
S. D. West, and R. O. Burger.
Journal of the Association of Official Analytical Chemists, Vol 63, No 6, p 1304-1309, November, 1980. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Pesticide residues, *Pollutant identification, *Fluridone, Herbicides, Gas chromatography, Analytical techniques, Fish.

The herbicide, fluridone (1-methyl-3-phenyl-5-(3-(trifluoro-methyl)phenyl)-4(1H)-pyridinone) and its major metabolite (1-methyl-3-(4-hydroxyphenyl)-5-(3-(trifluoromethyl)phenyl)-4(1H)-pyridinone) were determined in fish. The lower detection limit was 0.01 ppm, and recoveries averaged 84 + or - 14.7% for fluridone and 83 + or - 13.4% for the metabolite. Finely ground fish tissue was extracted with methanol, and the extract hydrolyzed with HCl to release the conjugated residues. After liquid-liquid partition purification with hexane and ethyl acetate, the sample was reacted with methyl iodide and brominated with phosphorus tribromide. Following Florisil column separation, the derivatives were quantified by electron capture gas liquid chromatography. (Cassar-FRC)
W81-01293

THE CHROMATOGRAPHIC AND GC/MS ANALYSIS OF ORGANIC PRIORITY POLLUTANTS IN WATER,
Finnigan Inst., Cincinnati, OH.
Q. V. Thomas, J. R. Stork, and S. L. Lammert.
Journal of Chromatographic Science, Vol 18, No 11, p 583-593, November, 1980. 5 Fig, 4 Tab, 6 Ref.

Descriptors: *Pollutant identification, *Gas chromatography, *Organic compounds, Water pollution, Analytical techniques, Legal aspects, Mass spectrometry, Separation techniques, Waste water, Sampling, Storage, Water analysis, Quality control, Data processing, Reviews, Water quality.

Of the US EPA's list of pollutants to be controlled under a 'Consent Decree' court ruling, 129 compounds and metals were designated as priority pollutants, based on their frequency of occurrence in point source industrial samplings. Methodology for the GC/MS analysis and chromatographic analysis for 114 of these priority pollutants in wastewater is reviewed, and sections on sampling, storage, equipment, sample preparation, and quality control are also included. Under the 'Best Available Technology' section of the Consent Decree a liquid-liquid concentration technique followed by GC/MS is recommended for TCDD (dioxin). Gas chromatographic methods using purge-and-trap concentration are applied to purgeable halocarbons and aromatics, plus acrolein and acrylonitrile. Phenols, phthalate esters, nitrosamines, pesticides, PCBs, nitroaromatics, polynuclear aromatic hydrocarbons (PAH), and haloethers are best analyzed by gas chromatography methods using liquid/liquid extraction. Liquid chromatography with liquid/liquid extraction is utilized for benzidine and its derivatives and PAHs. GC/MS methodology is also used in conjunction with liquid/liquid extraction at very acidic or basic pH levels for a number of phenolic compounds and pesticides and with purge trap concentration techniques for many of the purgeable organics. The legal aspects of the proposed analysis methods for the priority pollutants in relation to the National Pollutant Discharge Elimination System permits are also mentioned. (Geiger-FRC)
W81-01294

ISOLATION AND ENUMERATION OF FAECAL STREPTOCOCCI FROM NILE WATER (1975-1976),
Ministry of Agriculture and Water, Riyadh (Saudi Arabia).
F. A. Saleh.
Water Research, Vol 14, No 12, p 1669-1678, December, 1980. 6 Fig, 5 Tab, 38 Ref.

Descriptors: *Streptococcus, *Nile river, *Bioindicators, Separation techniques, Coliforms, Water pollution, Water pollution sources, Water analysis, Water quality, Farm wastes, Isolation, Rivers, Dams, Impoundments.

The value of the fecal streptococcus group as an indicator of water pollution was examined in 94 Nile River water samples taken from 3 segments of the river over a period of 16 months. Recovery of streptococci was performed by a modified thallous-azide technique and the standard M-enterococcus medium with a membrane filter method. Most probable number for fecal streptococcus was recorded with the aid of azide dextrose and ethyl violet azide (AD-EVA). The sources of fecal streptococci isolates were traced by four differential tests. The highest fecal streptococci readings of 100-1000/ml were recorded from water samples of the Cairo segment. Upon biochemical examination, about 78% of the strains recovered were assigned to atypical or unclassifiable categories. The remaining 22% were classified as S. faecalis and two of its variants, S. zymogenes and S. liquefaciens. All water samples tested were positive for the presence of streptococci. Results of TTC reduction and tellurite resistance tests suggested that the streptococci recovered were mostly of animal fecal origin. (Geiger-FRC)
W81-01340

CONTINUOUS MONITORING FOR SEWAGE-TREATMENT PURPOSES,
Severn-Trent Water Authority, Birmingham (England). Tame Div.
A. E. Hey.
Water Pollution Control, Vol 79, No 4, p 477-484, November, 1980.

Descriptors: *Monitoring, Analytical techniques, *Sewage treatment, *Activated sludge, Data transmission, Waste water treatment, Computers, Instrumentation, Suspended solids, Hydrogen ion concentration, Ammonia.

The continuous monitoring system for both biological filter and activated sludge plant effluents at the Minworth sewage treatment works is described. The station, located 60 meters from the activated sludge effluent discharge channel, contains a pumping system for automatic sampling, a system for distributing the samples to monitors, and a programmable electronic sequence timer for controlling sampling and valve-changing sequences. The monitoring system determines suspended solids by optical measurements, ammonia by gas sensing selective ion electrode, pH by electrode, and temperature by platinum resistance thermometer. Raw data is transmitted and updated at the receiving station every 2 minutes. Development work on extending the monitoring process to additional phases of the sewage treatment process is planned. (Cassar-FRC)
W81-01345

ISOLATION AND CHARACTERIZATION OF POLYMERIC ORGANIC MATERIALS IN A POLLUTED RIVER WATER,
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
R. Ishiwatari, H. Hamana, and T. Machihara.
Water Research, Vol 14, No 9, p 1257-1262, September, 1980. 4 Fig, 5 Tab, 9 Ref.

Descriptors: *Water pollution, *Rivers, Analytical techniques, Polymers, Resins, Organic compounds, Mass spectrometry, Oxidation, Separation techniques, Gas chromatography, Water analysis, *Tamagawa River(Japan), Japan, Water analysis, *Separation techniques, *Organic matter.

Amberlite XAD-2 resin was used to isolate organic matter from water samples taken from the Tamagawa River in Japan. With this technique, 40% of the total dissolved organic matter was isolated. The elemental compositions of the isolated organic materials from various locations were similar, amounting to carbon 41-48%, hydrogen 5.8-7.0% and nitrogen 4.7-6.7%. Other tests performed on the isolated material included molecular weight distribution, u.v. and i.r. spectra, and GC/MS analysis of alkaline potassium permanganate oxidation products. More than 50% of the isolated organic matter had molecular weights higher than 5000. Alkaline permanganate oxidation of the isolated organic materials produced aliphatic monocarboxylic acids, dicarboxylic acids and benzene-mono, di tri and tetracarboxylic acids. The relative amounts of these three groups can apparently be explained in terms of the nature and degree of pollution. (McKeon-FRC)
W81-01346

COLIPHAGES AS INDICATORS IN A TREATMENT PLANT,
Istituto Superiore di Sanita, Rome (Italy).
G. Ignazzitto, L. Volterra, F. A. Aulicino, and A. M. D'Angelo.
Water, Air, and Soil Pollution, Vol 13, No 4, p 391-398, December, 1980. 13 Tab, 6 Ref.

Descriptors: *Waste water treatment, *Bioindicators, *Coliforms, E. coli, Pollutant identification, Water pollution, Activated sludge, Analytical techniques.

Use of coliphages as indicators of water pollution was investigated in raw sewage influent, primary sedimentation tank effluent, and activated sludge effluent. Although fecal coliforms and coliphages showed a general reduction through the treatment process, the two populations were not always closely related. Water samples stored for 2 weeks showed a decay in plaque forming units. Several strains of E. coli were tested. Phage No. 8113 appeared to be the best marker. (Cassar-FRC)
W81-01352

DETERMINATION OF METALS IN SEWAGE EFFLUENTS,
T. B. Webster.
Water Pollution Control, Vol 79, No 4, p 511-514, November, 1980. 3 Tab, 27 Ref.

Descriptors: *Analytical techniques, *Sewage effluents, *Metals, *Pollutant identification, Spectrophotometry, Zinc, Copper, Iron, Lead, Nickel, Cadmium, Trace elements.

An improved method for analyzing metals at the microgram per liter level in sewage effluents is described. The sample undergoes nitric acid digestion to remove emulsion-producing substances. After neutralization and chelation, the sample is extracted with methyl isobutyl ketone. Analyses for zinc, copper, iron, lead, nickel, and cadmium are carried out using a Pye-Unicam SP90 Series 2 atomic absorption spectrophotometer coupled with a 10mV recorder. Reagent blanks should be run at

the same time and corrections made to compensate for trace metals in the nitric acid and other reagents. By increasing the sample to solvent ratio, lower limits of detection are possible. (Cassar-FRC)
W81-01356

BACTERIOLOGICAL MONITORING OF POLLUTION IN SHELLFISH: METHODOLOGICAL EVALUATION,
Instituto Superiore di Sanita, Rome (Italy). Lab. di Igiene del Territorio.
L. Volterra, F. A. Aulicino, E. Tosti, and M. Zicarelli.
Water, Air, and Soil Pollution, Vol 13, No 4, p 399-410, December, 1980. 1 Fig, 6 Tab, 9 Ref.

Descriptors: *Pollutant identification, *Coliforms, *Shellfish, Analytical techniques, Water pollution, Bacteria, Mussels, Gulf of Pozzuoli, *Naples(Italy), *Italy.

Three different methods of determining fecal pollution in shellfish were compared. The first method, proposed by the Italian Government, uses flesh and intervalve water obtained from groups of 10 shellfish each, diluted with saline solution, to analyze for total and fecal coliforms by the most probable number technique. Method 2, proposed by the British Ministry of Agriculture, Fisheries, and Food, uses the flesh only of 20 shellfish diluted with 0.1% peptone water to analyze for bacteria by the pour plate method. The third method, WHO/UNEP, uses 25 grams of shellfish flesh without intervalve water, diluted with 1% peptone water and analyzed by the most probable number technique. Inclusion of intervalve water in the sample introduces a variability factor, decreasing or increasing the bacterial counts depending on quality of the growing water. In general, the most probable number of techniques give higher values than the pour plate (direct count) method. Sample size does not affect results. Simultaneous analyses on flesh, intervalve water, and growing water show great variations in bacterial contamination. (Cassar-FRC)
W81-01371

5B. Sources Of Pollution

CHARACTERIZATION OF STORM RUNOFF IN LAS VEGAS VALLEY, NEVADA,
Nevada Univ. System, Reno. Water Resources Center.
For primary bibliographic entry see Field 4C.
W81-01205

OPPORTUNITIES FOR U.S. FISH AND WILDLIFE SERVICE INITIATIVES RELATED TO URANIUM MINING AND MILLING IN THE WESTERN UNITED STATES,
Enviro Control, Inc., Fort Collins, CO.
G. C. Horak, and J. E. Olson.
In: Proceedings of the Uranium Mining and Milling Workshop, May 28-29, 1980, Fort Collins, Colorado, Fish and Wildlife Service Report FWS/OBS-80/57, August, 1980, p 14-61. 2 Fig, 12 Tab, 60 Ref.

Descriptors: *Uranium mining, *Wildlife, *Mine wastes, *Radioactive wastes, Wildlife habitats, Water pollution, Mills, Mineral industry, *Environmental effects, Trace elements, Radioactive waste disposal, Air pollution.

In the western United States, uranium mining and milling have disturbed 14,900 hectares. Because annual uranium production is predicted to increase nearly seven-fold by the year 2000, mining and milling are expected to impact an additional 57,200 hectares. Exploration will temporarily impact an additional 724,500 hectares. Potential impacts of conventional uranium mining include habitat destruction, air pollution, water pollution, radiation exposure, and trace element toxicity. Unconventional mining may cause less surface disturbance, and the site may be easier to reclaim. The principle impact to fish and wildlife resulting from milling activities, exclusive of tailings disposal, is surface habitat destruction. Mill tailings ponds and piles represent a source of direct injury or contamination of wildlife, radon emanations, pond seepage, and spills of tailings through dike breaches. Mill decommissioning and mine reclamation may not have a major impact on fish and wildlife, but inactive tailing sites present a hazard until they are decontaminated. The Fish and Wildlife Service is now involved in the early planning of uranium projects, standards settings, and research and development program planning to reduce the impacts of uranium mining and milling. (Moore-SRC)
W81-01216

SANDIA'S ACTIVITIES IN URANIUM MILL TAILINGS REMEDIAL ACTION,
Sandia National Labs., Albuquerque, NM.
S. Neuhauser.
In: Proceedings of the Uranium Mining and Milling Workshop, May 28-29, 1980, Fort Collins, Colorado, Fish and Wildlife Service Report FWS/OBS-80/57, August, 1980, p 68-73. 1 Tab, 1 Ref.

Descriptors: *Uranium mill tailings, *Radioactive waste disposal, *Environmental effects, Wildlife habitats, Soil contamination, Water pollution, Hydrology, Land use, *Pollution abatement.

The Uranium Mill Tailings Radiation Control Act of 1978 requires that remedial action be taken at over 20 inactive uranium mill tailings sites. The proposed standards promulgated under this Act by the Environmental Protection Agency require cleanup of soil and contaminated structures at existing locations. In several cases the present sites are felt to be too close to human habitations or to be otherwise unacceptably located, and these tailings will probably be relocated. The candidate alternative sites must satisfy certain geophysical, hydrological, and meteorological criteria. Environmental impact studies at these sites must consider not only the direct impacts of relocation efforts at present and proposed sites, but also land-use policies, socio-economic factors, the impacts of borrow pit and roadway construction, and other factors. A vital part of these studies, of course, is consideration of potential effects on fish and wildlife and mitigating actions to restore or improve unavoidably affected habitats. The possibility of contamination of wildlife at tailings sites both before and after stabilization requires further study. (Moore-SRC)
W81-01217

EPA ACTIVITIES FOR THE CONTROL OF URANIUM MINING AND MILLING EFFLUENTS,
Environmental Protection Agency, Denver, CO.
P. Wagner.
In: Proceedings of the Uranium Mining and Milling Workshop, May 28-29, 1980, Fort Collins, Colorado, Fish and Wildlife Service Report FWS/OBS-80/57, August, 1980, p 77-87. 1 Fig, 2 Tab.

Descriptors: *Uranium mining, *Radioactive wastes, *Water pollution sources, Radioactive waste disposal, Wildlife, Soil contamination, Environmental effects, Mine wastes, Mills, Groundwater, Regulation, Inter-agency cooperation, Pollution abatement.

Uranium mining and milling operations can result in the contamination of the environment with technologically enhanced natural radioactivity. The primary pathways by which radioactivity reaches a dose receptor are: direct external gamma exposure from airborne or groundwater deposited radionuclides; inhalation of radioactive materials; ingestion of radionuclides through contaminated foodstuffs; and ingestion of contaminated water. Congress has provided the Environmental Protection Agency (EPA), Nuclear Regulatory Commission (NRC), and Department of Energy (DOE) with a patchwork of Acts directed at specific processes associated with uranium mining and milling. In many cases, EPA has been ordered to set standards in consultation with NRC and DOE, and the latter two agencies are to implement them. Existing, proposed, or planned regulations will protect the environment from all effluents except groundwater contamination from milling activities. In addition to developing regulations for the uranium fuel cycle, EPA aids NRC Agreement states in their review of impact reports submitted by applicants for milling licenses. NRC solicits EPA review of environmental impact statements that NRC develops for milling projects under its jurisdiction. Future cooperation with the Fish and Wildlife Service may aid EPA efforts to control mining and milling effluents. (Moore-SRC)
W81-01218

DETERMINATION OF ATMOSPHERIC PHOSPHORUS ADDITION TO LAKE MICHIGAN,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
S. J. Eisenreich, P. J. Emmling, and A. M. Beeton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-219124, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-063, July, 1980. 60 p, 11 Fig, 10 Tab, 36 Ref, 1 Append. R 803238.

Descriptors: *Lake Michigan, *Phosphorus, Chemistry of precipitation, *Water pollution sources, Great Lakes, Eutrophication, Nutrients, Precipitation(Atmospheric), Air pollution, Seasonal, Aeolian soils, Path of pollutants, Air entrainment, Lake basins.

Lake Michigan has a large surface area, but a small drainage basin suggesting that the atmosphere may be a significant source of natural and anthropogenic components representing a sizeable portion of the total nutrient budget. Bulk precipitation was collected on a monthly basis in the Lake Michigan basin for 18 months during 1975-1976 to determine atmospheric phosphorus loadings to Lake Michigan. The sampling network consisted of bulk collectors at 23 land stations and 2 in-lake buoys located off urban and rural areas. Annual phosphorus loading to Lake Michigan from atmospheric sources was 1,690,000 kg in 1976, which represents 15.7% of the total budget based on 1975 data. In 1976, atmospheric deposition of phosphorus in Lake Michigan was dominated by a dry fall component likely derived from wind-blown soil. Actual in-lake loading of phosphorus may exceed loading calculated from land-based stations by up to 50%. The phosphorus weighted average concentration in bulk precipitation was 0.050 and 0.064 mg/l in the north and south basins, respectively, as compared to the average lake water concentration of 0.01 mg/l. Seasonal variations in loading rates showed maxima in late spring and early summer, and minima in winter. Wet-only precipitation concentrations for phosphorus averaged 15% of bulk deposition values, and the pH averaged one unit lower than bulk deposition. (Moore-SRC)
W81-01236

ORGANOCHLORINE COMPOUNDS IN AQUATIC ENVIRONMENTS,
Labor Inspection Directorate, Oslo (Norway).
For primary bibliographic entry see Field 5A.
W81-01250

ACCUMULATION OF COPPER IN FLUVIAL SEDIMENTS AND YELLOW WATER LILLIES (NUPHAR LUTEA) AT VARYING DISTANCES FROM A METAL PROCESSING PLANT,
Turku Univ. (Finland). Dept. of Biology.
K. Aulio.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 5, p 713-717, November, 1980. 1 Fig, 1 Tab, 13 Ref.

Descriptors: *Copper, *Plant tissues, *Fluvial sediments, Sediments, Metals, Deposition, Plant physiology, Sediment load, Industrial wastes, Heavy metals, *Finland, *River Kokemaenjoki(Finland).

The accumulation of copper in fluvial sediments and in dominant aquatic vegetation in the vicinity of a point source of heavy metal pollution was investigated. Samples of sediment were collected from the River Kokemaenjoki in western Finland. The site under study is located near a base metal purification and processing plant in Pori, which

produces an annual amount of 40-50,000 tons of copper with a discharge of 24 kg/d of copper into the river. The levels of copper in the sediments near the plant indicate an enrichment of discharged metals. The highest concentration of total copper was 1020 ppm. Accumulation of metal took place only in a narrow shallow water zone 0-8 m from shoreline. Levels of copper in deep water sediments were from 17 to 54 ppm. Most of the copper load is carried downstream and enters the Baltic Sea. The copper accumulated in various plant organs of the Nuphar lutea showed increased levels when compared to plants away from the site. Highest recorded concentrations for leaves and petioles were 98 and 115 ppm, respectively. Concentrations in below-ground organs of the plant were low, indicating selectivity in uptake/exclusion and translocation in the plant. The condition of the plants indicated extreme tolerance to heavy metal contamination. (Baker-FRC)
W81-01252

DISTRIBUTION OF POLYCHLORINATED BIPHENYLS IN THE FORT EDWARD, NEW YORK, WATER SYSTEM,
Rensselaer Polytechnic Inst., Troy, NY.
M. Brinkman, K. Fogelman, J. Hoeflein, T. Lindh, and M. Pastel.
Environmental Management, Vol 4, No 6, p 511-520, November, 1980. 3 Fig, 4 Tab, 25 Ref.

Descriptors: *Polychlorinated biphenyls, *Water pollution sources, *Chemical wastes, Water quality, Fort Edward(NY), Aquatic life, Soil, Sediments, Reservoirs, Impoundments, Potable water, Industrial wastes, Pollutant identification, Organic compounds.

Concentrations of polychlorinated biphenyls (PCBs) were determined in water, soils, sediment, and aquatic life of the Fort Edward, New York, water system, an area less than 0.5 km from a PCB disposal site. Types of PCB identified in samples were Arochlor 1016 and 1254. Water from reservoirs and the distribution system had significant and uniform PCB levels (median 100 nanograms per liter). Seven samples of groundwater and streams feeding the reservoirs showed no detectable PCB. The Hudson River at Fort Edward contained 530 ng per liter 5 times the reservoir level. A 30-day composite rainfall sample showed high levels of Arochlor 1016 (1,300 ng per liter), suggesting that this may be the principal source of PCB contamination in the reservoir system. One of the 13 samples of reservoir sediment contained 190 ng per g; the remaining 12, 40 ng per g or less. Similarly, the 5 soil samples showed wide variation. One level was high, 160 ng per g; and the others, 30 ng per g or less. PCB was more concentrated in the biota than in water or sediment. Twenty of 32 samples of algae and animal life contained detectable PCB, with a prefernce for the more highly chlorinated form. The macroinvertebrates, sediment dwellers, showed high levels of 580 ng per g. Estimates of total PCB level in the drinking water were 104 ng per liter, less than the 160 ng per liter limit used by the New York State Health Department. Efforts to reduce this low level of PCB are best directed toward reducing input from the sources. (Cassar-FRC)
W81-01256

MODELLING GROUNDWATER CONTAMINATION FROM LAND-APPLIED SWINE WASTE,
British Columbia Univ., Vancouver. Dept. of Bio-Resource Engineering.
For primary bibliographic entry see Field 7B.
W81-01273

TRANSPORT OF TRACE ELEMENTS IN ECOSYSTEMS OF THE BARHALDE WATERSHED IN THE SOUTHERN BLACK FOREST,
Institut fuer Bodenkunde und Waldernahrungslehre, Freiburg im Breisgau (Germany, F.R.).
K. Stahr, H. W. Zottl, and FR. Hadrich.
Soil Science, Vol 130, No 4, p 217-224, October, 1980. 6 Fig, 3 Tab, 15 Ref.

Descriptors: *Trace elements, *Chemistry of precipitation, *Metals, Beryllium, Copper, Water analysis, Soil chemical properties, Rainfall, Runoff, Lead, Cadmium, Germany, *Black Forest(Federal Republic of Germany), Heavy metals, *Path of pollutants.

Concentrations of trace elements and macroelements in rainfall, canopy drip, runoff, and soil solution were determined in a very cool, humid section of the Balck Forest. Samples were collected at four free-drained and three hydromorphic sites, and the concentrations of 20 elements and the pH of the samples were determined. Beryllium had the lowest input and the highest output. It was primarily mobilized in the mineral topsoil, and only a small amount was reabsorbed by humic acids or top soil or taken up by plants. None was leached by leaves. Lead concentrations were highest in precipitation, but only about 5% of the input appeared in the output. Cadmium, copper, and lead were all absorbed by the humus and iron oxide accumulation horizons of podzols and Ockererde. Copper was absorbed in all soils except podzols, and cadmium was not absorbed in mineral soil. Recent increases in atmospheric output of these trace minerals probably resulted in the enrichment and rise of turnover. (Small-FRC)
W81-01278

ISOLATION AND CHARACTERIZATION OF BACTERIA FROM THE BALTIC SEA,
Swedish Water and Air Pollution Research Lab., Stockholm.
A. H. Neilson.
Journal of Applied Bacteriology, Vol 49, No 2, p 199-213, October, 1980. 2 Fig, 5 Tab, 70 Ref.

Descriptors: *Bacteria, *Baltic Sea, *Salt tolerance, Alteromonas putrefaciens, Pseudomonas, Aerobic bacteria, E. coli, Water pollution, Pollutants.

Samples of water and sediment from 3 localities in the Baltic Sea (a control site and two sites subjected to industrial discharge) were examined to determine bacterial populations. The areas subject to pollution showed the highest numbers of bacteria, which included Enterobacteriaceae, Pseudomonas, Aeromonas hydrophila, Alteromonas putrefaciens, and Gram positive bacteria. None of the isolates had an absolute requirement for NaCl. The majority of isolates were salt tolerant, though of fresh water origin, and able to grow aerobically at salinities comparable to sea water. However, the Enterobacteriaceae were not able to grow anaerobically under comparable conditions. Samples of E. coli, Klebsiella pneumoniae and Yersinia enterocolitica survived for three weeks at 17C in sea water lacking carbon and nitrogen nutrients. Therefore, the persistence of pathogens in saline water should be re-evaluated. (Cassar-FRC)
W81-01291

DISTRIBUTION OF OIL POLLUTION RESIDUES,
Sydney Univ. (Australia). Dept. of Chemical Engineering.
I. A. Furzer.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE6, p 1171-1189, December, 1980. 13 Fig, 2 Tab, 26 Ref.

Descriptors: *Mathematical models, *Oil pollution, *Estuaries, Rivers, Water pollution, Model studies, Path of pollutants, Sediments, Oxygenation, Water quality control, Tides, Sedimentation, Oil spills.

A new mathematical model was devised to simulate the distribution of residues from oil pollution along the length of a closed estuary. The proposed model is comprised of a dual system of continuously stirred tank reactors. Oil pollution residues which start out in suspension in the aqueous phase are transferred by settling to the sediments of the tanks. The settling rate of the residues constitutes an important parameter of the model, which can be evaluated by minimizing a least squares error objective function between the simulated and observed distribution of oil pollution residues along the system. A CYBER computer and an effective numerical technique were employed to solve the system of equations. Oil pollution residues were evaluated in the Parramatta and Duck Rivers of Australia using this model. Results showed that these rivers, conservatively estimated, contain 8,000 tons of oily residues. It was estimated that clean up of this particular pollution problem would take several decades. The new sediment model systems will be able to cover single and multipoint pollution sources and are recommended for use in the water quality management of closed estuaries. (Geiger-FRC)
W81-01295

WAIKATO RIVER POLLUTANT FLUSHING RATES,
Hamilton Science Center (New Zealand).
J. C. Rutherford, M. E. U. Taylor, and J. D. Davies.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE6, p 1131-1150, December, 1980. 10 Fig, 5 Tab, 13 Ref.

Descriptors: *Dyes, *Dispersion, *Environmental engineering, *Rivers, Dye concentrations, Potable water, Mathematical models, Tracers, Water supply, Pollution, Water quality, Advection, Longitudinal dispersion, Similarities, Waikato River, New Zealand, On-site investigations, *Path of pollutants.

A dye dispersion experiment was conducted in the Waikato River in New Zealand in order to appraise methods of protecting the supply of potable water. Results showed persistent lateral inhomogeneity of concentration even well below the advective zone. The Fickian model of longitudinal dispersion described the dye profiles near the peak, but predicted pollutant arrivals and departures prematurely. Tracer data exhibited characteristics of a self-similar process in which average concentrations at any point can be calculated from peak concentration, arrival time, and duration of concentrations above half the peak, using a single scaling curve. A hybrid technique was developed for routing pollutant slugs along a nonuniform channel. It makes use of the Fickian model, and it reconstructs the entire concentration profile with greater accuracy. (Titus-FRC)
W81-01299

BLOOM-FORMING CYANOBACTERIUM MICROCYSTIS AERUGINOSA OVERWINTERS ON SEDIMENT SURFACE,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
T. Preston, W. D. P. Stewart, and C. S. Reynolds.
Nature, Vol 288, No 5789, p 365-367, November 27, 1980. 2 Fig, 14 Ref.

Descriptors: *Path of pollutants, *Algae, *Water pollution sources, Cyanophyta, Microcystis aeruginosa, Odor-producing algae, Sediments, Epilimnion, Stratification, Water quality, Reservoirs, Lakes.

Experiments with N15 tracer incorporated into NaNO3 fertilizer showed that Microcystis aeruginosa, a bloom-forming blue-green alga, overwintered on the sediment surface in an experimental pond and provided an inoculum of colonies from which the following year's epilimnetic population developed. After addition of the labelled fertilizer to the water in August, 1976, an extensive Microcystis aeruginosa bloom developed in the epilimnion. In October the colonies migrated to the sediment surface, forming a clearly visible layer 1.0 cm thick. N15 was removed from the water by flushing in February, 1977. Particulate N15 in the water increased to a maximum in May, then declined in June with the onset of thermal stratification. In July and August the N15 concentration and Microcystis population were present in the surface waters. In late September M. aeruginosa and N15 particulates sedimented. (Cassar-FRC)
W81-01302

USE OF SELECTED FRESHWATER BIVALVES FOR MONITORING ORGANOCHLORINE PESTICIDE RESIDUES IN MAJOR MISSISSIPPI STREAM SYSTEMS, 1972-73,

Bureau of Marine Resources, Long Beach, MS.
R. L. Leard, B. J. Grantham, and G. F. Pessoney.
Pesticides Monitoring Journal, Vol 14, No 2, p 47-52, September, 1980. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Pesticide residues, *Water pollution sources, *Clams, Mississippi, DDE, DDT, Toxaphene, Methyl parathion, Chlordane, Halogenated pesticides, Agricultural runoff, Aquatic animals, Bioindicators.

Seven species of freshwater clams, collected in 13 streams representing 5 river basins throughout Mississippi, were analyzed for pesticide content. Highest levels of toxaphene and DDT were found in the streams located in agricultural regions. DDT and its metabolites showed a large reduction between 1972 and 1973, corresponding with decreased usage of DDT and with large-scale flooding in the state. Although no pesticide residues were found in 1972 water samples, toxaphene and methyl parathion were detected in water samples from some sites in 1973, reflecting an increase in use of these chemicals. However, toxaphene in clam samples decreased between 1972 and 1973. Chlordane was found in only 2 samples in 1972. Clams were shown to be effective monitors of pesticide content. C. manilensis was proved the best indicator of change, having higher and lower levels than the other species. Pesticide levels in water samples did not reflect concentrations in biota. (Cassar-FRC)
W81-01303

PESTICIDES IN GROUND WATER BENEATH IRRIGATED FARMLAND IN NEBRASKA, AUGUST 1978,
Nebraska Univ., Lincoln. Conservation and Survey Div.
R. F. Spalding, G. A. Junk, and J. J. Richard.
Pesticides Monitoring Journal, Vol 14, No 2, p 70-73, September, 1980. 1 Fig, 1 Tab, 17 Ref.

Descriptors: *Pesticide residues, *Water pollution, Pollutant identification, Potable water, Atrazine, Alachlor, Irrigation water, Herbicides, Nebraska, Nitrates, Chlorinated hydrocarbon, Pesticides.

Samples of water from 14 irrigation wells in the Central Platte region of Nebraska were analyzed for residues of 13 pesticides and nitrate-nitrogen. Atrazine, the most commonly used herbicide in this area, was found in all samples. Levels ranged from 0.06 to 3.12 micrograms per liter. Nitrate-nitrogen concentrations, which ranged from 17.1 to 34.3 mg per liter, correlated with atrazine levels with a coefficient of r = 0.55. Alachlor levels above 0.01 micrograms per liter appeared in 2 samples. It is believed that both atrazine and alachlor migrated vertically to the ground water. Levels of 2,4-D, EPTC, silvex, simazine, lindane, dieldrin, heptachlor, heptachlor epoxide, endrin, and methoxychlor were below detectable limits. DDT and DDE levels were less than 0.01 micrograms per liter. Although all reported levels were below limits for drinking water standards, the atrazine-nitrate combination is capable of forming nitrosamines. (Cassar-FRC)
W81-01304

MOVEMENT OF CHLORIDE IN A SOIL WITH VARIABLE CHARGE PROPERTIES: I. CHLORIDE SYSTEMS,
Sydney Univ. (Australia). Dept. of Soil Science.
For primary bibliographic entry see Field 5E.
W81-01323

MOVEMENT OF CHLORIDE IN A SOIL WITH VARIABLE CHARGE PROPERTIES: II. SANITARY LANDFILL LEACHATE,
Sydney Univ. (Australia). Dept. of Soil Science.
For primary bibliographic entry see Field 5E.
W81-01324

NOTE ON HEAVY METAL CONCENTRATION IN THE AQUATIC ENVIRONMENT OF THE KITAKYUSHU DISTRICT IN JAPAN, 1976-1977,
Kitakyushu Municipal Inst. of Environmental Health Sciences (Japan).
H. Sakino, A. Hashimoto, Y. Uchimura, S. Tateishi, and T. Akiyama.
Water Research, Vol 14, No 9, p 1233-1237, September, 1980. 2 Fig, 3 Tab, 3 Ref.

Descriptors: *Water pollution, *Heavy metals, *Rivers, *Industrial wastes, Cadmium, Copper, Lead, Estuaries, Sea water, Analytical techniques, Japan, Kitakyushu, Dokai Bay(Japan).

Heavy metals concentrations in the aquatic environment of the Kitakyushu district in Japan were investigated from 1976 to 1977. Cadmium, copper and lead samples were analyzed for all rivers which run through the area, the bay, and the sea surrounding the district. Results obtained were compared with values found in the literature for metals concentrations in other parts of the world. This comparison showed no significant pollution except for concentrations of lead in Dokai Bay, which averaged 40 micrograms per liter. The industrial activity surrounding the bay was responsible for the high concentrations of lead. (McKeon-FRC)
W81-01338

LINEAR ALKYLBENZENE SULFONATES IN RIVER, ESTUARY AND BAY WATER,
Tokyo Metropolitan Univ. (Japan), Dept. of Chemistry.
H. Hon-nami, and T. Hanya.
Water Research, Vol 14, No 9, p 1251-1256, September, 1980. 4 Fig, 3 Tab, 13 Ref.

Descriptors: *Rivers, *Estuaries, *Sea water, *Alkylbenzene sulfonates, Bays, Detergents, Foaming, Analytical techniques, Biodegradation, Statistical methods, Water pollution, Japan, Tama River(Japan), *Tokyo Bay.

Linear alkylbenzene sulfonates (LAS) in aquatic environments were determined by combined gas-liquid chromatography (GLC) and mass spectrometry (MS). LAS were determined as their methyl sulfonate derivatives by GLC-MS. The ratios of the concentrations of LAS to those of methylene blue active substances (MBAS) in river and bay water were estimated to be 0.40-0.85 and less than 0.20 respectively. The major components of LAS in the commercial detergent were the C(11) and the C(12) LAS. The LAS composition in the waters did not vary appreciably with season or with sampling location. In river and estuary water, compared to commercial detergent, the proportions of C(12) and C(13) LAS decreased, while those of C(10) and C(11) LAS increased. The 2-phenyl isomer decreased. These findings agree with predictions based on biodegradation rates of pure LAS in river water. The LAS composition in bay water did not follow these predictions; the proportions of C(10) and C(11) LAS slightly decreased while those of C(12) and C(13) LAS increased compared with the river and estuary waters. (McKeon-FRC)
W81-01348

POTENTIAL SIGNIFICANCE OF INSECTS IN THE REMOVAL OF CONTAMINANTS FROM AQUATIC SYSTEMS,
EG and G, Inc., Waltham, MA.
C. A. Menzie.
Water, Air, and Soil Pollution, Vol 13, No 4, p 473-479, December, 1980. 1 Fig, 2 Tab, 22 Ref.

Descriptors: *Insects, *Water pollution, Sediments, Chemical wastes, Aquatic insects, Aquatic soils, Wastes, Path of Pollutants, Mathematical models, Bioindicators, Water quality, Projections.

Insects which live in water and sediments during the larval stage may remove chemical contaminants from this system when they leave the aquatic environment as adults. The extent of contamination removal was estimated by a simple model using the following factors: concentration of chemical contaminant, time interval, production of larval biomass, bioconcentration factor, proportion of biomass removed by adult emergence, density of sediment, and depth of sediment. Three levels of insect production (100, 15, and 1 gram per square meter per year) and 3 bioconcentration factors (10,000, 1,000, and 100X) were considered. Using the highest production and bioconcentration figures, insects could remove 50% of contamination from a 30 cm thick sediment layer in 1.2 years. The lowest production and bioconcentration conditions would require 12,000 years for the same 30 cm sediment. Moderate production levels with bioconcentration factor of 10,000 would result in removal of 50% of the contamination in 8 years; a factor of 1,000, 80 years. (Cassar-FRC)
W81-01354

CASE STUDIES OF ACRYLAMIDE POLLUTION RESULTING FROM THE INDUSTRIAL USE OF POLYACRYLAMIDES,
Plymouth Polytechnic (England). Dept. of Environmental Science.
L. Brown, M. M. Rhead, and K. C. C. Bancroft.
Water Pollution Control, Vol 79, No 4, p 507-510, November, 1980. 2 Tab, 16 Ref.

Descriptors: *Acrylamide, *Polyacrylamides, *Industrial wastes, Water pollution sources, Pulp and paper industry, *Waste water treatment, Polymers, China industry, Pollutant identification, Potable water.

Acrylamide, which has a low recommended concentration (0.25 micrograms per liter) in potable waters, biodegrades slowly. Therefore, effluents from several industries using polyacrylamides were analyzed to determine acrylamide levels. Process waters and effluents from a china clay factory which recycles water showed no acrylamide (detection limit, 0.2 micrograms per liter). A laboratory-scale 100 fold overdose of polymer resulted in an acrylamide concentration of 11.2 micrograms per liter. No detectable acrylamide was found in effluents from a sewage works using polymers for sludge conditioning. A deliberate 100-fold overdose in a settlement tank showed a maximum of 0.7 micrograms per liter in stream water receiving the effluent. In tests at 3 paper mills, no detectable acrylamide was found in 2 mills. The third mill showed about 10 micrograms per liter in pulping recycle water. Final effluent contained less than 1 microgram per liter, and river water below effluent discharge, less than 0.2 micrograms per liter. It was determined that high acrylamide levels in recycle water were a result of the waste paper reclamation process. Chlorination of water smaples containing acrylamide (0 to 500 micrograms per liter) did not reduce acrylamide concentration. (Cassar-FRC)
W81-01355

UNUSUAL BEHAVIOUR OF CILIATED PROTOZOA IN A SECONDARY SETTLEMENT TANK,
Yorkshire Water Authority (England). Southwestern Div.
For primary bibliographic entry see Field 5D.
W81-01358

MOUNTAIN RESIDENTIAL DEVELOPMENT-MINIMUM WELL PROTECTIVE DISTANCES-WELL WATER QUALITY,
California State Univ., Northridge. Dept. of Health Science.
K. L. Ford, J. H. Schott, and T. J. Keefe.
Journal of Environmental Health, Vol 43, No 3, p 130-133, November/December, 1980. 1 Fig, 3 Tab, 9 Ref.

Descriptors: *Well spacing, *Water pollution control, *Water quality, Colorado, Domestic wastes, Waste water disposal, Wells, Septic tanks, Coliforms, Nitrates, Jefferson County(CO).

Well water samples were collected and wells were inspected in 164 sites within a 300 square mile area in a mountainous portion of Jefferson County, Colorado, an area which has experienced rapid population growth. Analysis for coliform bacteria and nitrate nitrogen revealed that coliform contamination was not related to lot size or distance from waste water effluent sources. However, there was a definite relationship between nitrate-nitrogen concentration and these factors. A statistical study

showed that wells with a protective distance of 100 feet had a 21.8% probability of contamination (greater than 10 mg per liter of nitrate-nitrogen); a 200 foot distance reduced the probability to 9.4%. Therefore, a 200 foot minimum distance from the nearest effluent source was recommended. This requires a lot size of about 2 acres. (Cassar-FRC)
W81-01363

THE EFFECT OF STORM INTERVAL ON THE TRANSPORT OF SOLUBLE PHOSPHORUS IN RUNOFF,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
A. N. Sharpley.
Journal of Environmental Quality, Vol 9, No 4, p 575-578, October/December, 1980. 5 Fig, 3 Tab, 17 Ref.

Descriptors: *Phosphorus, *Rainfall-runoff relationships, Movement, *Storm runoff, Soil chemical properties, Simulated rainfall, Model studies, Nutrients, Watersheds, Water quality, Enzymes, Organic compounds, Soil water, Water pollution, Percolation, Leaching, Path of pollutants, *Oklahoma.

The effect of varying the interval between runoff events on the level of soluble phosphorus was examined under conditions of simulated rainfall in Oklahoma. During each runoff event the levels of soluble phosphorus decreased. When the interval between each pair of runoff events was decreased from 1 day to 5 minutes, the soluble phosphorus levels increased from 0.027 to 0.033 milligrams/liter in Bernow fine sandy loam, and from 0.020 to 0.028 milligrams/liter for Woodward loam soils. This was suspected to be due to a movement of soil water down the profile after the runoff process ended, which caused a reduction in the pool of soluble phosphorus in the surface soil that is susceptible to leaching during runoff. Contrastingly, when event intervals were increased from 1 to 6 days, a marked increase in the mean concentration of soluble phosphorus in runoff was noted. Mean levels of soluble phosphorus under these conditions rose from 0.018 to 0.026 milligrams/liter for Bernow and 0.011 to 0.041 milligrams/liter for Woodward soils. This increase was correlated with the phosphatase enzyme activity of the soils examined, and therefore could be partially due to organic phosphorus mineralization. (Geiger-FRC)
W81-01364

LOSS OF CHLORPHYRIFOS IN POND WATER: EXAMINATION OF RESULTS USING THREE SIMPLE MATHEMATICAL MODELS,
Manitoba Univ., Winnipeg. Pesticide Research Lab.
G. J. Reimer, and G. R. B. Webster.
Journal of Environmental Science and Health, Part B, Vol 15, No 5, p 559-569, 1980. 2 Tab, 7 Ref.

Descriptors: *Chlorpyrifos, *Water pollution, *Pesticide kinetics, Model studies, Mathematical models, Pollutants, Pesticides, Halogenated pesticides, Persistence, Degradation, Ponds.

Two formulations of chlorpyrifos, the active ingredient in Dursban insecticide, were added at the recommended dose of 0.04 mg per 100 liters to outdoor pools during the summer months. Half-life of the emulsifiable concentrate was 5 + or - 3 hours; of slow release granules, 14 + or - 4 hours. This data was analyzed using three simple mathematical models: a power rate model, a hyperbolic rate model, and an empirical power function. The average correlation coefficients were approximately 0.78, 0.84, and 0.76, indicating that all models showed similar performance. (Cassar-FRC)
W81-01366

INVESTIGATIONS OF PIPE-BORNE WATER POLLUTION IN BENIN CITY, NIGERIA,
Benin Univ. (Nigeria). Dept. of Biological Sciences.
E. J-Nkanga.
Water, Air, and Soil Pollution, Vol 13, No 4, p 425-437, December, 1980. 6 fig, 6 Ref.

Descriptors: *Benin City(Nigeria), *Water pollution sources, *Public health, *Bacteria, Water quality, Coliforms, Construction, Plumbing, Domestic wastes, Pipes, Septic tanks, Soil disposal fields, Rainfall, Potable water, *Nigeria.

The source of the high level of bacterial contamination in the public water supply of Benin City, Nigeria, was investigated. The combined effects of rainfall with excessive construction work and the inadequate plumbing codes were identified as the two most important causes of this pollution. Construction on roads, use of an underground sewage collection system, and a telephone cable installation led to frequent water pipe breaks. Samples were taken in 4 main zones characterized, respectively, by extensive road construction, combined construction projects, no public construction, and a residential area using toilets with septic tanks and disposal fields. Samples were also collected at pumping stations and a river to determine the quality of the water before passing through consumer pipelines. Peak rainfall periods corresponded with peak coliform counts in areas of heavy construction. Rainfall had little effect in the area where construction was insignificant. Contamination increased from 12 coliforms per 100 ml to 60 per 100 ml as water lines passed through an area containing septic tanks and drain fields. Artificial contamination studies showed that rainfall increased bacterial count in pipe-borne water passing through absorption fields. (Cassar-FRC)
W81-01372

HEAVY METAL INPUTS TO MISSISSIPPI DELTA SEDIMENTS--A HISTORICAL VIEW,
Texas A and M Univ., College Station. Dept. of Oceanography.
B. J. Presley, J. H. Trefry, and R. F. Shokes.
Water, Air, and Soil Pollution, Vol 13, No 4, p 481-494, December, 1980. 7 Fig, 2 Tab, 34 Ref.

Descriptors: *Heavy metals, *Rivers, Mississippi River, Lead, Cadmium, *Water pollution, Sediments, Zinc, Trace elements, Deltas, Waste dilution, Municipal wastes, Industrial wastes, *Mississippi Delta.

Sampling and analysis of suspended particulates, filtered water, and sediments from the Mississippi River, its delta, and adjacent marshes during 1974-1976 showed that sediment Cd and Pb concentrations increased by 70% and 200% respectively over the past several decades. Particulate matter in the river contains more than 90% of the metal load, which resembles the chemical composition of average rocks in levels of Fe, Al, V, Cr, Cu, Mn, and Ni. However, Pb and Zn are about 3 times more concentrated in river particulates than in the average rock crust; Cd, 7 times. River particulate matter and delta sediments are similar in levels of Al, Fe, Cr, V, Cd, and Pb, but Co, Cu, Mn, Ni, and Zn in sediments are 20 to 40% less, probably due to diagenic losses. Dissolved metal concentrations, similar to world average values for rivers, were below limits for safe drinking water. The Mississippi River is capable of carrying enormous loads of industrial and municipal metal wastes without significantly increasing background metal levels. This is possible because of the abundant suspended matter, high pH, and large volume of water. (Cassar-FRC)
W81-01373

DEVELOPMENT OF A WINTERTIME BIOMONITOR FOR HEAVY METALS IN FLOWING WATERS,
Michigan Technological Univ., Houghton. Dept. of Biological Sciences.
J. M. Glime, and R. R. Keen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157067, Price codes: A04 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, Project Completion Report, January, 1981, 50 p, 4 Fig, 18 Tab, 37 Ref. OWRT A-107-MICH(1), 14-34-0001-0124.

Descriptors: *Bioindicators, *Mosses, *Lake Superior, Monitoring, Water quality, Biomonitor, Winter, Aquatic moss, *Heavy metals, Copper, Cadmium, *Fontinalis, Aquatic toxicology, Alkalinity, Humic acids.

Two species of Fontinalis were cultured at 1 and 5C in Lake Superior water with experimentally varied alkalinity and humic acid, copper and cadmium concentrations, to determine the suitability of using these mosses as wintertime biomonitors for heavy metal contamination. Both species exhibited growth and healthy appearance at 1 and 5C. Alkalinity and humic acids had no significant effect on the chlorophyll content or appearance of the moss within the range of concentrations known in Michigan. Copper caused reduced chlorophyll and visible loss of color at 1 mg/l in four days at 1C. Cadmium caused reduced chlorphyll and visible loss of color only at 35 upsilon g/l and above after 10 days of exposure at 1C. Cellular re-organization paralleled color response to both copper and cadmium. Several species of mosses were compared for ease of recognizing stress symptoms. Fontinalis hypnoides var. durisei and Eurhynchium riparioides had the most easily recognized macroscopic response.
W81-01374

INDICATOR-ORGANISM PERSISTENCE IN ACID-MINE-WATER ENVIRONMENTS,
West Virginia Univ., Morgantown. Water Research Inst.
N. E. Carlson, and G. K. Bissonnette.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157075, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, 1981. 41 p, 8 Fig, 8 Tab, 58 Ref. OWRT-A-039-WVA(1), 14-34-0001-0152.

Descriptors: *Acid mine water, *Bioindicators, *Coliforms, Microbiology, *Sewage bacteria, Streptococcus, *Water quality, Bacteria, Domestic wastes, E. Coli, Enteric bacteria, Microorganisms, Mine water, Sewage effluents, Waste water(Pollution), Water pollution.

Persistence of indicator organisms (total coliforms, fecal coliforms, and fecal streptococci) associated with natural samples of raw, primary- and secondary-treated sewage was studied following in-situ exposure to five aquatic environments. Three of these streams contained significant amounts of acid mine drainage. The other two streams were relatively uncontaminated. Indicator organisms were rapidly killed upon exposure to the acid-mine systems. In most cases, the survivors were reduced more than 90% within 30 minutes. Little reduction in numbers was observed in the uncontaminated streams. Seasonal changes affected survival of indicators as reflected by slightly prolonged persistence at colder in-situ water temperatures. The fecal coliform group was most susceptible to the acid-mine-water stress. The fecal streptococci were the most persistent. An enrichment technique resulted in substantially enhanced recovery of sublethally-injured survivors of acid stress. Enrichment was particularly beneficial for recovery of acid-injured fecal coliforms. Relatively little improvement in recovery of fecal streptococci was afforded by the enrichment technique.
W81-01378

5C. Effects Of Pollution

OPPORTUNITIES FOR U.S. FISH AND WILDLIFE SERVICE INITIATIVES RELATED TO URANIUM MINING AND MILLING IN THE WESTERN UNITED STATES,
Enviro Control, Inc., Fort Collins, CO.
For primary bibliographic entry see Field 5B.
W81-01216

SANDIA'S ACTIVITIES IN URANIUM MILL TAILINGS REMEDIAL ACTION,
Sandia National Labs., Albuquerque, NM.
For primary bibliographic entry see Field 5B.
W81-01217

SEASONAL FLUCTUATIONS OF MAJOR DIATOM SPECIES AT FIVE STATIONS

ACROSS LAKE MICHIGAN, MAY 1970-OCTOBER 1972,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Sciences.
R. E. Holland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-110975, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-066, July, 1980. 95 p, 33 Ref, 2 Append. R-805133-01-1.

Descriptors: *Lake Michigan, *Diatoms, *Eutrophication, *Seasonal, Phytoplankton, Aquatic environment, Nutrients, Water pollution, Great Lakes, Aquatic productivity, Solar radiation, Summer, Winter, Plant populations, Temporal distribution, Distribution patterns.

Recent investigations have demonstrated significant differences between inshore and offshore waters in Lake Michigan which show that inshore environments are deteriorating at a much faster rate than offshore environments. In the past, conclusions concerning changes in the Great Lakes have been based on data from inshore water samples, and engineering studies have been based upon the assumption that the entire volume of the lake was available for dispersion of pollutants. From 27 May 1980 to 4 October 1972, water samples were collected from five stations on a transect across Lake Michigan from Milwaukee, Wisconsin to Ludington, Michigan. At all stations, diatoms reached their highest abundance in late spring to early summer. These periods of greatest abundance of total diatoms were the result of the rapid growth of one or two species. Stephanodiscus hantzschii was the dominant species at Station 1, off Milwaukee, and Rhizosolenia eriensis was the dominant species or one of the predominant diatom when highest yearly numbers were reached at Stations 3 and 5 in August, 1972. Highest winter numbers were reached at Station 1 on 22 February, 1972 when Stephanodiscus minutus was dominant at all stations. Solar radiation appears to be the limiting factor in the productivity of winter plankton. There were differences between inshore and offshore stations, but Station 1 was most distinct and reflected the continued input of nutrients from the Milwaukee area. (Moore-SRC)
W81-01223

AN EVALUATION OF HAZARDOUS CHEMICALS IN LAKE ONTARIO DURING IFYGL,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
G. F. Lee.
Environmental Protection Agency Report EPA-600/3-80-060, July, 1980. 34 p, 1 Fig, 9 Tab, 8 Ref. R-803187.

Descriptors: *Lake Ontario, *Heavy metals, *Water pollution, *Chlorinated hydrocarbon pesticides, *Polychlorinated biphenyls, Water quality, Great Lakes, Fish, DDT, Cadmium, Zinc, Chromium, Copper, Fluoride, Iron, Lead, Nickel, Manganese, Ammonia, Dieldrin.

Data collected during the International Field Year for the Great Lakes (IFYGL) studies during 1972-73 on Lake Ontario are summarized relative to either recommended International Joint Commission (IJC) Research Advisory Board water quality objectives or Environmental Protection Agency Quality Criteria for Water. Data from 247 stations are summarized for the following parameters: cadmium, zinc, chromium, copper, fluoride, iron, lead, nickel, manganese and ammonia. Almost all reported measurements for total cadmium exceeded the IJC water quality objective of 0.2 microgram/l by at least five times. Values reported for copper also showed a high percentage of measurements equal to or in excess of the recommended IJC water quality objective. Other metals showed more regional patterns of values equalling or exceeding water quality objectives. The concentrations polychlorinated biphenyls, dieldrin and DDT and its metabolites in water and fish were found to exceed both the IJC water quality objectives and the Quality Criteria for Water. The polychlorinated biphenyl content of the water ranged from 40 to 97 ng/l with an average of 55 ng/l, which is 50 times the Quality Criteria for Water. If the IFYGL data are representative of Lake Ontario conditions, studies need to be conducted to evaluate whether these concentrations are indicative of water quality deterioration. (Moore-SRC)
W81-01226

RESULTS OF A LIMNOLOGICAL STUDY OF LAKE POCASSE, SOUTH DAKOTA,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
R. A. Roline, and J. F. LaBounty.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-141905, Price codes: A03 in paper copy, A01 in microfiche. Report REC-ERC-80-4, June, 1980. 47 p, 22 Fig, 16 Tab, 31 Ref.

Descriptors: *Limnology, *Water chemistry, *Heavy metals, *Anaerobic conditions, South Dakota, Water temperature, Dissolved oxygen, Cyanophyta, Primary productivity, Nutrients, Sediments, Zooplankton, Aquatic life, Eutrophication, Copper, Lead, Zinc, Manganese, Iron, Polychlorinated biphenyls, Water pollution, *Lake Pocasse(SD).

In 1977-78, a limnological study was done on Lake Pocasse, South Dakota, to evaluate the present condition of the lake and to assist in the feasibility decision of using the lake as a regulating reservoir. The shallow depth (3 to 4 m) allows for water temperatures during the summer to reach 25 degrees C with very little stratification. The dissolved oxygen in the water is usually maintained at levels adequate for the survival of aquatic organisms during the ice-free period, but may frequently approach anaerobic conditions during winters with heavy snow and ice cover. Potentially toxic levels of the heavy metals copper, lead, zinc, manganese, and iron have been measured, but these elements are usually in the less harmful particulate form. Anaerobic conditions may contribute to the release of the ionic forms of heavy metals which are highly toxic to aquatic life. No insecticides or herbicides were detected in any of the samples except for the Spring Creek sample which contained 0.001 mg/l polychlorinated biphenyls. The levels of nitrogen and phosphorus compounds measured accounted for the high primary production during the late summer and fall. A bloom of the blue-green alga Aphanizomenon flos-aquae (L.) Ralfs occurred during this period. Zooplankton populations generally were greatest during midsummer and the population of benthic organisms continued to increase throughout the season. Lake Pocasse appears to act as a trap for sediments, nutrients, and heavy metals because of limited and irregular flushing. (Moore-SRC)
W81-01238

MOVEMENTS OF LAKE TROUT IN TWIN LAKES, COLORADO, IN RELATION TO THE MT. ELBERT PUMPED-STORAGE POWERPLANT,
Colorado Cooperative Fishery Research Unit., Fort Collins.
L. A. Walch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-130049, Price codes: A04 in paper copy, A01 in microfiche. Engineering and Research Center, Water and Power Resources Service, Report REC-ERC-79-17, July, 1980. 76 p, 15 Fig, 4 Tab, 90 Ref, 9 Append.

Descriptors: *Lake trout, *Fish behavior, *Entrainment, *Pumped storage, Environmental effects, Colorado, Seasonal, Tailrace, Water temperature, Distribution, Movement, Fish management, Powerplants, Reservoirs, Diurnal distribution, Depth, *Twin Lakes(CO).

Mean movement rates of 34 lake trout (Salvelinus namaycush) tagged with ultrasonic transmitters in Twin Lakes, Colorado, ranged from 1.1 m/min in the fall to 1.6 m/min in the summer. Movement rates between 0830 and 1130 were significantly higher than between 2230 and 0500 during spring, summer, and fall. During the fall, afternoon movements were significantly greater than night movements. Home range sizes of lake trout were larger during the spring, summer, and fall than during the winter. Of the home ranges observed, at least 40% were found in the proximity of the tailrace at all times of the year. More excursions out of home ranges occurred during the spring and fall than during the summer or winter. Gill netting data indicated that lake trout were more likely to be found near the tailrace during spring and fall than during summer or winter. During the summer, lake trout were found to prefer deep areas of the lower lake. Between July and October, they occupied depths where water temperatures in the lower and upper lakes averaged 10.5 and 8.5 degrees C, respectively. Few excursions into water warmer than 12 degrees C occurred. Most lake trout were found within 3 m of the bottom. Movements of fish to within 15 m of shore occurred in all seasons and usually took place between 0600 and 1300. Ripe lake trout were captured at depths ranging from 1.5 to 12 m, but were not captured near the powerplant. It is likely that the lake trout of Twin Lakes will be least vulnerable to entrainment by pumping operations between 2230 and 0500 and most vulnerable between 0830 and 1130 during spring, summer, and fall. Seasonally, they will be least vulnerable in the winter and most vulnerable in the spring.
W81-01239

RELATIVE EFFECTS OF BACTERIAL AND PROTOZOAN PREDATORS ON SURVIVAL OF ESCHERICHIA COLI IN ESTUARINE WATER SAMPLES,
Tasmania Univ., Hobart (Australia). Faculty of Agricultural Science.
J. McCambridge, and T. A. McMeekin.
Applied and Environmental Microbiology, Vol 40, No 5, p 907-911, November, 1980. 1 Fig, 2 Tab, 16 Ref.

Descriptors: *Estuaries, *Coliforms, *Predation, Aquatic habitat, Estuarine environment, Bacteria, Sea water, Microorganisms, E. coli, Sewage bacteria, Cultures, Protozoa, Aquatic life, Microbiology.

The relative effect of protozoan and bacterial predators on the survival of Escherichia coli in estuarine water samples was examined. A bacterial suspension was added to fresh estuarine water samples, and antibiotics were added to determine the effect of bacterial predators alone. The time interval during which predacious protozoa were active in a 10-day-decline period was determined by the exposure of Escherichia coli to these predators for different lengths of time. After this exposure, protozoan predators were inhibited for the remainder of the experiment. Predacious protozoa were found to exert their major influence during the first two days of the decline period. The early effect of protozoa and the suppression of bacterial predators by these protozoa suggest that there may be interacting microbial predators, each playing a distinct role in the destruction of fecal bacteria after their introduction into estuarine conditions. (Titus-FRC)
W81-01247

LIMNOLOGICAL STUDIES ON INORGANIC ACID LAKES IN JAPAN (IN JAPANESE),
National Inst. for Environmental Studies, Yatabe, (Japan).
For primary bibliographic entry see Field 2H.
W81-01266

TEMPORARY PIPELINE AVERTS WATER QUALITY EMERGENCY.
For primary bibliographic entry see Field 5G.
W81-01284

EFFECT OF THE WARM WATER DISCHARGE FROM A POWER STATION ON FISH POPULATIONS IN THE RIVER TRENT,
Central Electricity Generating Board, Ratcliffe-on-Soar (England). Freshwater Biology Unit.
K. Sadler.
Journal of Applied Ecology, Vol 17, No 2, p 349-357, August, 1980. 3 Fig, 4 Tab, 20 Ref.

Descriptors: *Fish, *Water discharge, *Temperature, Heated water, Water temperature, Perches,

Fish behavior, Fish populations, Ecology, Operation and maintenance, Thermal properties, Fish migration, Aquatic environment, Environmental effects, *Power plants, England, River Trent(England).

Seine netting was conducted monthly at stations above and below a power station to determine the effect of warm water discharge on fish populations. Nine species of fish were tracked, three in statistically significant quantities. Statistical tests were conducted where possible. Results indicate that fish population densities and species diversity were greater downstream in warmer waters. Reduction in catch during the winter months suggests a seasonal migration. This reduction occurred in December in the downstream site, 1 to 2 months later than in the upstream site. Temperature increments caused by power station operation were a mean value of 6 to 8 degrees Centigrade above ambient, with a peak of 28C. Literature data indicates that 30C is the point at which thermal stress in fish appears. (Titus-FRC)
W81-01286

EFFECT OF VARYING MG/CA RATIO AND ELECTROLYTE CONCENTRATION IN THE IRRIGATION WATER ON THE SOIL PROPERTIES AND GROWTH OF WHEAT,
Central Soil Salinity Research Inst., Karnal (India).
J. S. P. Yadav, and I. K. Girdhar.
Plant and Soil, Vol 56, No 3, p 413-427, September, 1980. 5 Fig, 7 Tab, 23 Ref.

Descriptors: *Wheat, *Irrigation water, Magnesium, Water quality, Calcium, Soil properties, Salinity, Electrolytes, *Crop response.

The effect of irrigation waters having varying Mg/Ca ratios (2, 4, 8, and 16) and electrolyte concentrations (20 and 80 meq/liter) on growth of wheat in pots was studied using two different soils. The two soils were a heavy-textured black soil dominated by montmorillonite clay and a light-textured alluvial soil with illite type clay. As irrigation water of higher electrolyte concentration was used, salinity increased. The rate of increase was greater in the heavy soil. Soluble salts accumulated in the surface layers of both soils when saline water was applied. As the Mg/Ca ratio and electrolyte concentration of the irrigation water increased, the Na and Mg absorption in the soils increased, and the wheat crop was significantly reduced. Effects were more pronounced in the heavy soil than in the light alluvial soil. Soil pH increased with increases in Mg/Ca ratio and decreased with increases in electrolyte concentration. Soil pH was higher in the surface layer than in the subsurface layer. (Cassar-FRC)
W81-01305

AN EQUITABLE APPROACH TO POLLUTION CONTROL WITH PARTICULAR REFERENCE TO THE THAMES ESTUARY,
Thames Water Authority, London (England). Directorate of Scientific Services.
L. B. Wood, and A. G. Cockburn.
Progress in Water Technology, Vol 12, No 3, p 83-91, 1980. 3 Fig, 1 Tab, 4 Ref.

Descriptors: *Equity, *Oxygen requirements, *Estuaries, Dissolved oxygen, Fish, *Water pollution control, Salinity, Flow, Mathematical models, Rivers, Thames River(England), England.

The preparation of the pollution budget for the Thames Estuary is described with special reference to biodegradable loads. Also, the extension of the procedure to other substances is discussed. The Thames Estuary is divided into three salinity zones: Canvey Island to the North Sea, London Bridge to Canvey Island, and Teddington to London Bridge. In the first zone, the minimum percentage of air saturation with dissolved oxygen must be at least 60% in 95% of the samples collected. The water must be suitable for the whole life cycle of marine organisms. In the second zone, dissolved oxygen must be at least 40% in 95% of the samples, and the water must be non-toxic to fish. The dissolved oxygen pollution budget is related to the effects of biodegradable discharges in the third quarter of the year. The parameter for measuring potential pollution load is the Effective Oxygen Load, which equals 3/2 times the oxidizable nitrogen in mg/liter, times the flow rate in cu m/day, times 10 to the sixth power. Mathematical modelling using the steady-state model (Barrett, Mollowney, and Casapieri, 1978) is used to evaluate the discharge standards for an effluent in a particular area. (Small-FRC)
W81-01313

THE STATE OF THE NILE ENVIRONMENT: AN OVERVIEW,
United Nations Environmental Programme, Nairobi (Kenya).
E. E. El-Hinnawi.
Water Supply and Management, Vol 4, No 1-2, p 1-11, 1980. 2 Fig, 1 Tab, 18 Ref.

Descriptors: *Rivers, *Environmental effects, *Dam construction, Lakes, Watersheds(Basins), Eutrophication, Aquatic plants, Bacteria, Dissolved oxygen, Human diseases, *Nile River, Kenya.

The main environmental changes that have occurred or are anticipated as a result of development of the Nile basin are reviewed. The most important environmental impacts are related to the construction of dams and the creation of manmade lakes. The filling of a new lake causes geochemical and biochemical changes such as stratification, eutrophication, bacterial growth, and deoxygenation. Water hyacinth, water fern and water lettuce increase water loss by evaporation and use nutrients which could be used by fish. Placid lake waters as well as the rapid flows through dam sluices have aided the spread of water-borne human disease. The concept of ecodevelopment is explained, and monitoring is urged to protect the Nile, one of the world's least polluted rivers. (Small-FRC)
W81-01327

WATER SUPPLY PROBLEMS IN THE CONSTRUCTION AND OPERATION OF AN OIL PIPELINE: A CASE STUDY OF THE SAINT LAWRENCE LOWLANDS,
Institut National de la Recherche Scientifique, Rimouski (Quebec).
D. Couillard.
Water Supply and Management, Vol 4, No 5/6, p 397-407, 1980. 1 Fig, 1 Tab, 22 Ref.

Descriptors: *Potable water, *Oil spills, *St. Lawrence River, Quebec, Groundwater, Water pollution sources, Pipelines, Rivers, Water quality, Oil industry, Engineering structures, Leakage, Environmental effects, Pollution.

Effects of oil spills from construction and operation of a proposed petroleum pipeline and tank farms on the south shore of the St. Lawrence River, Quebec, on the water supply in this area are discussed. Within the study area there are over 75 localities which draw their water supply from rivers. Twenty-seven communities and numerous individual households depend on groundwater. The quality of river water and groundwater varies but is generally good. The most serious result of oil leakage into the environment would be contamination of the groundwater. In sand and gravel aquifers, pollution disperses quickly over a large region and degrades very slowly. Since the pipeline will cross many water courses, a spill could contaminate a community's water potable supply and adversely affect aquatic life. Chlorination of a water source containing even trace amounts of oil can produce phenolic compounds with disagreeable taste and odor. Contamination of rivers disperses more quickly than in groundwater. Nevertheless, emergency plans and alternative sources should be formulated by each community. A temporary adverse effect of pipeline construction is increased sediment loads in the water. (Cassar-FRC)
W81-01332

DETRIMENTAL EFFECTS OF PHARMACEUTICAL INDUSTRIAL WASTE ON MICROORGANISMS,
Z. H. Coll. of Engineering and Technology, Aligarh (India). Environmental Research Lab.
M. Ajmal, A. Ahmad, M. Z. Hasan, and A. A. Nomani.
Water, Air, and Soil Pollution, Vol 13, No 4, p 447-452, December, 1980. 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Microorganisms, *Industrial wastes, *Pollutants, Bacteria, Antibiotics, Chemical wastes, *Pharmaceutical wastes, Environmental effects.

A sample of industrial waste from Cooper Pharma Limited, Ghaziabad, India, manufacturer of products including vitamins, aspirin, and anitbiotics, was analyzed and its effects on microorganisms determined. The pungent, yellow material, pH 5.5, had the following properties, expressed in mg per liter: suspended solids, 455; total solids, 2520; dissolved solids, 1780; and turbidity, 985. Chemical properties, also listed in mg per liter, were: BOD, 390; COD, 1850; organic nitrogen, 24; inorganic nitrogen, 12.5; sulfur, 5.1; chlorides, 14.9; sulfates, 9.5; phosphates, 4.2; volatile solids, 280; and dissolved oxygen, nil. Varying volumes of the waste, ranging from 0.5 ml to 12 ml, were added to 300 ml BOD bottles, which were then filled with distilled water. Bacterial cultures, saprophytic, nitrifying, and a combination of both, were added. Results showed that 0.5 ml of waste had no detrimental effects on any bacteria. Slight effects were noticed at 1 or 2 ml. Definite detrimental effects were seen at 10 to 12 ml for each bacterium separately and in combination. The author suggests that large volumes of pharmaceutical industrial waste should not be discharged into the environment without dilution or treatment. (Cassar-FRC)
W81-01353

DOES DRINKING WATER HARDNESS AFFECT CARDIOVASCULAR DISEASE,
Delaware Div. of Public Health, Dover.
M. Joyce.
Journal of Environmental Health, Vol 43, No 3, p 134-139, November/December, 1980. 6 Tab, 16 Ref.

Descriptors: *Potable water, *Cardiovascular disease, *Hardness(Water), Magnesium, Calcium, Public health, Water quality, Metals, Trace elements.

The relationship of drinking water hardness to cardiovascular disease is reviewed by examining published literature. Higher cardiovascular disease mortality rates are found in soft water areas than in hard water areas. General conclusions are that hard water may lower intestinal absorption of toxic metals, trace elements (chromium, vanadium, lithium) normally associated with hard water may contribute to proper nutrition and better general health, and the corrosive effect of soft water may cause higher levels of harmful materials (lead, cadmium, and copper) in drinking water. Calcium and magnesium, common constituents of hard water, appear to have a protective effect against cardiovascular disease. If further clarification of these relationships proves that cardiovascular disease is caused by certain drinking water trace elements, current water treatment practices should be modified. (Cassar-FRC)
W81-01362

THE EFFECTS AND CONTROL OF ALGAL BLOOMS IN FISH PONDS,
Centre Technique du Genie Rural, Monpellier (France). Amenagements Littoraux et Aquaculture.
E. A. Seymour.
Aquaculture, Vol 19, No 1, p 55-74, January, 1980. 2 Fig, 5 Tab, 55 Ref.

Descriptors: *Cyanophyta, *Carp, *Ammonia, Nitrogen, Phosphorus, Aquatic algae, Aquatic weed control, Algal toxins, Fisheries, France, *Fish ponds.

The development of a dense bloom of a blue green alga (Aphanizomenon flos-aquae) in the ponds of a carp farm in the south of France was investigated. Temperature, surface dissolved oxygen, hardness,

and total inorganic nitrogen content of the pond water were measured throughout the season. Changes in the cover of macrophytes in the pond were also determined. About one day after the collapse of the bloom, carp gathered at the inflow to the pond, where they gasped at the surface. Ten days after the bloom collapse, netted carp had distended abdomens and internal hemorrhages. Twenty-one days after the bloom collapse, 10-20% of the carp had skin lesions and other problems. Total carp mortality was only 11%. Concentrations of non-ionized ammonia in the pond were measured after the bloom. These measurements, along with earlier laboratory findings, indicated that infectious dropsy of carp is caused by ammonia. It is suggested that dense blooms of nitrogen-fixing algae can be controlled by manipulation of the nitrogen-phosphorus balance of ponds. (Small-FRC)
W81-01418

5D. Waste Treatment Processes

CAPTURE OF LATEX BEADS, BACTERIA, ENDOTOXIN, AND VIRUSES BY CHARGE-MODIFIED FILTERS,
AMF Cuno, Meriden, CT.
K. Hou, C. P. Gerba, S. M. Goyal, and K. S. Zerda.
Applied and Environmental Microbiology, Vol 40, No 5, p 892-896, November, 1980. 5 Fig, 4 Tab, 12 Ref.

Descriptors: *Filtration, *Microorganisms, Methodology, Filters, Water pollution, Water quality, Kinetics, Laboratory tests, Bacteria, Flow, Waste water treatment, *Water treatment.

A study of filtration methods indicates that electropositive filters are effective in the removal of a wide range of microorganisms over a wide range of pH values and ionic conditions. The use of these filters has potential application in the removal of microorganisms from water, concentration of both bacteria and viruses from water, and harvesting for removal of endotoxins from contaminated parenterals and foods and for immobilization of microbial cells and antigens. These filters depend upon electrokinetic effects on microorganisms and suspended matter which exhibit a net negative charge in most fluids. Electronegative filters of similar porosity and electropositive filters that had been treated to destroy the charge were ineffective under similar conditions. (Titus-FRC)
W81-01240

HANDLING HAZARDOUS WASTES,
Battelle-Columbus, OH.
For primary bibliographic entry see Field 5E.
W81-01263

FULL-SCALE EVALUATION OF HIGH RATE SCREENING DEVICES FOR TREATMENT OF SANITARY SEWAGE BY-PASS FLOW,
Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
H. Kronis, and F. Tonelli.
Environment Canada, Canada-Ontario Agreement on Great Lakes Water Quality Research, Report No 103, 1980. 145 p, 33 Fig, 25 Tab, 11 Ref, 3 Append.

Descriptors: *Bypasses, *Sewage treatment, *Sanitary engineering, *Waste water(Pollution), *Screens, Canada, Infiltration, Flow rates, Routing, Spillways, Channels, Floodways, Disposal, Civil engineering, Effluents, Treatment, Sewage, Wastes, Equipment, Filters, Sieves, Size, Peak discharge, Water pollution control, Storm surge, Technology.

Four fine-mesh high-rate screening devices were evaluated for their ability to treat combined sewage from wet and dry weather conditions. The devices tested were: a 1.5 meter diameter Centrifugal Waste water Concentrator with 105 micrometer screen openings, a 1.5 meter long rotating horizontal drum screen (Rotostrainer) with 500 micrometer apertures, and two stationary inclined screens (one, a 0.6 meter wide stationary hydraulic sieve, the other, a 1.8 meter wide Hydrasieve, having 305 and 762 micrometer apertures, respectively). The study was conducted during 1974-75 at the Belleville, Ontario Water Pollution Control Plant, where influent sewage is subject to substantial infiltration, dilution, and flow peaking during wet weather. Observed hydraulic capacity (16-50 gallons per minute-square foot) and pollutant removal depended largely on screening device type, aperture size, and availability of an effective backwash system. Typical mean pollutant removals during storm events with first flush conditions were: 5-32% for suspended solids, 5-24% for BOD-5, and 23-79% for settleable solids. Pollutant reductions were much less in dry weather. Operating costs (0.6-19 cents/1000 gallons) depended on several factors. It was concluded that screening had potential for pollutant reduction in combined sewer flows. (Zielinski-IPA)
W81-01267

NUTRIENT REMOVAL FROM DRAINAGE WATERS WITH SYSTEMS CONTAINING AQUATIC MACROPHYTES,
Florida Univ., Sanford. Inst. of Food and Agricultural Sciences.
L. R. Sinclair, and R. B. Forbes.
Transactions of the ASAE, Vol 23, No 5, p 1189-1194, October/November, 1980. 1 Fig, 4 Tab, 21 Ref.

Descriptors: *Water pollution treatment, *Aquatic plants, *Lake Apopka(FL), *Nutrient removal, Water quality, Drainage water, Biological treatment, Water treatment, Water hyacinth, Swamps, Muck soils, Najus, Eutrophication.

Water quality was measured at the inflow and outflow of three treatment systems to determine their effectiveness in removing nutrients from agricultural drainage water. The study was adjacent to Lake Apopka, Florida, which has undergone eutrophication during the past 50 years from nutrients added by drainage water from muck farming. A natural swamp was not very effective in improving water quality. Turbidity, sulfate, pH, and nitrates were slightly reduced, and alkalinity, ammonia, phosphate, tannin-lignin, carbon dioxide, and temperature increased slightly. Oxygen concentration decreased significantly. An anerobic system, floating water hyacinths planted in a 16.2 hectare reservoir, improved water quality slightly through the growing season. Nitrates, oxygen, phosphates, and sulfate decreased; other changes were not statistically significant. This method was most effective of the three in nitrate removal. After the water hyacinths started to decay, water quality degenerated. A 0.4 hectare recycle reservoir containing Najus, submerged plants, removed nutrients very effectively. In this aerobic process, alkalinity, ammonia, carbon dioxide, phosphate, tannin-lignin, turbidity, and sulfate decreased significantly, and oxygen and pH increased significantly. This system was effective in winter. The author speculated that a combination of naiad and hyacinth systems might produce improved results. The possibility of using emergent plants such as cat tails was also mentioned. (Cassar-FRC)
W81-01270

FLUID MECHANICS-FOAM FLOTATION INTERACTIONS,
Nevada Univ. System, Las Vegas. Water Resources Center.
R. M. French, and D. J. Wilson.
Separation Science and Technology, Vol 15, No 5, p 1213-1227, June, 1980. 6 Fig, 2 Tab, 10 Ref.

Descriptors: *Mathematical models, *Flotation, Froth flotation, Water pollution treatment, *Fluid mechanics, *Waste water treatment.

A simple mathematical model for describing the interaction of fluid mechanics and surface chemistry in particle attachment to bubbles in foam flotation columns is suggested. This information is insignificant in the study of pollutant removal from waste waters by foam flotation. This model, an air bubble with a single attached floc particle rising in a Stokes flow regime through a liquid pool at the bottom of a batch foam flotation column, was used to calculate the viscous forces acting to separate bubble and particle. Comparisons with previous work showed that magnitudes, but not directions, of viscous forces can be correctly estimated. (Cassar-FRC)
W81-01280

REVERSE OSMOSIS SEPARATION OF THIOSALTS FROM MINING EFFLUENTS,
Barringer Magenta Ltd., Rexdale (Ontario).
K. S. Subramanian, M. Malaiyandi, and V. S. Sastri.
Separation Science and Technology, Vol 15, No 5, p 1205-1211, June, 1980. 6 Tab, 10 Ref.

Descriptors: *Reverse osmosis, *Sulfur compounds, *Mine wastes, *Metals, *Waste water treatment, Membrane processes, Separation techniques, Sulfates, Industrial wastes, Chemical wastes, Effluents, Cellulose acetate.

Reverse osmosis using a cellulose acetate membrane was evaluated as a possible method for removal of thiosalts from mine tailings ponds. Separation of sodium sulfate, sodium thiosulfate, sodium dithionate, potassium thrithionate, and potassium tetrathionate reached a maximum at 300 psig. Separation efficiencies ranged from 82.2% to 92.9%. Twelve plant effluents containing varying thiosalts and metal ions were subjected to reverse osmosis at 300 psig. Tables listing concentrations of each ion before and after treatment indicate that a large percentage of contaminants were removed. Effluent waters were analyzed for metal ion content and found satisfactory for recycling in the plant or discharge into nearby streams. (Cassar-FRC)
W81-01281

WATER HYACINTHS FOR WASTE WATER TREATMENT,
Boyle Engineering Corp., Orlando, FL.
H. W. Haeseker, and S. C. Helle.
Public Works, Vol 111, No 12, p 34-36, December, 1980.

Descriptors: *Water hyacinth, *Waste water treatment, *Effluents, Water levels, Pilot plant, Biochemical oxygen demand, Water balance, Flow, Water pollution, Aquatic plants, Secondary treatment, Tertiary treatment.

The effectiveness of water hyacinths for waste water treatment is discussed. Water hyacinths grow rapidly in nutrient-rich water, producing biomass which can be digested to generate fuel gas or used as a protein source for animals and perhaps humans. The harvested plants can also be composted to produce an organic soil conditioner. Tests in a pilot waste treatment plant in Florida demonstrated that hyacinths have viable potential for waste treatment. Concentrations of total suspended solids and biological oxygen demand were reduced 80 to 90% with an effluent detention period of 5 days. Effluent was applied at rates of 17,000 gallons per day through three channels. Hyacinths were harvested once a month. Loading rates for secondary and tertiary treatment, cost-benefit analyses, and water budgets remain to be determined. (Titus-FRC)
W81-01285

KINETICS OF PURE OXYGEN ACTIVATED SLUDGE,
Technion - Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
G. Shelef, and M. Green.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE6, p 1099-1110, December, 1980. 7 Fig, 4 Tab, 20 Ref.

Descriptors: *Activated sludge, *Aeration, *Kinetics, Oxygen, Sewage treatment, Growth rates, Solubility, Biomass, Dissolved oxygen, Degradation, Wastes, Waste water, Evaluation.

Experiments comparing activated sludge systems aerated by air with those aerated by pure oxygen

found the following kinetic parameters to be identical: yield coefficient, decay coefficient, and substrate removal coefficient. The two systems operated under identical conditions with the exception of dissolved oxygen concentrations, which ranged from 0.3 to 3.0 milligrams per liter in the air system and from 10 to 18 milligrams per liter in the oxygen system. No differences in sludge settling characteristics were noted. Contrary to some claims, the results indicate that the sole advantages of pure oxygen are due to higher partial pressure and the corresponding force of its dissolution. (Titus-FRC)
W81-01297

UPGRADING LAGOON EFFLUENTS WITH ROCK FILTERS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
G. R. Swanson, and K. J. Williamson.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE6, p 1111-1129, December, 1980. 8 Fig, 3 Tab, 19 Ref.

Descriptors: *Algae, *Lagoons, *Sewage treatment, Filtration, Effluents, Filter stones, Oregon, Rocks, Sedimentation, Water pollution, Water quality, Filters, Operation and maintenance, Model studies, Mathematical models, Sewage effluents.

Rock filtration is an effective, low-cost unit process for removing algae from effluents and correspondingly upgrading lagoon treatment. It consists of a submerged bed of rocks through which lagoon effluent passes horizontally. Sedimentation is the primary mechanism of algae removal. A mathematical model of the sedimentation mechanism indicated that total suspended solids removal efficiency is a function of the distribution of algal settling distance in the rock filter. Weekly average effluent biochemical oxygen demand and total suspended solids from the pilot facility in Oregon did not exceed 20 milligrams per liter during a one year study, and settling rates averaged 0.05 meters per day. Rock filters require a minimum of labor for operation and maintenance, and appear to be compatible with typical lagoon facilities. (Titus-FRC)
W81-01298

LIQUID WASTE REDUCTION TECHNOLOGY FOR INDUSTRIES DEMONSTRATED BY THE TREATMENT OF SUGAR BEET WASTE WATER,
Technische Hochschule, Vienna (Austria). Inst. fuer Wasserversorgung Abwasserreiningung und Gewasserschuts.
H. Kroiss.
Progress in Water Technology, Vol 12, No 3, p 263-270, 1980. 6 Fig, 1 Tab, 6 Ref.

Descriptors: *Food processing industry, *Anaerobic digestion, *Aerobic treatment, Activated sludge, *Waste water treatment, Recirculated water, Industrial wastes, Costs, Municipal wastes, Combined treatment, *Sugar beet industry.

Internal and external measures used in the sugar beet industry to reduce liquid wastes are described, and cost estimates are provided. Internal measures, or measures taken during sugar beet processing, include multiple usage of fresh water and simultaneous treatment of the waste water with activated sludge. Effluent quality averages BOD less than 15 mg/liter and COD less than 60 mg/liter after internal biological treatment. Secondary waste water treatment can be applied if internal measures are limited to the removal of settable solids by primary sedimentation and reuse of the mechanically treated waste water for fluming and washing the beets. Several suggested treatment schemes are: (1) Combined treatment in a municipal treatment plant, (2) High rate anaerobic treatment with consecutive treatment in a municipal treatment plant, (3) High rate aerobic treatment with consecutive treatment in a municipal treatment plant, and (4) Low rate aerobic treatment. Costs have been estimated for each. Climbing energy costs make high rate anaerobic treatment attractive. (Small-FRC)
W81-01307

A DESIGN STUDY OF BIOCHEMICAL COMBINED WASTE WATER TREATMENT PLANT,
National Water Board of Finland, Helsinki. Tampere Water District.
P. Rantala.
Progress in Water Technology, Vol 12, No 3, p 271-278, 1980.

Descriptors: *Chemical precipitation, *Trickling filters, *Municipal wastes, Aluminum, On-site investigations, Industrial wastes, Design, Treatment facilities, Finland, Combined treatment, *Waste water treatment.

The design study for upgrading a chemical waste water treatment plant for the city of Tampere (Finland) is described, which evaluated various process modifications. Three modifications were tested which could reach the required effluent standards of BOD less than 25 mg/liter and total phosphorus under 1 mg/liter. Pilot plant studies were carried out over a period of three and one half years for the following: (1) trickling filter with plastic media (Flocor) - post precipitation with aluminum sulfate; (2) simultaneous precipitation, activated sludge with simultaneous ferrous precipitation and a possible pre-precipitation, with existing treatment plant; and (3) simultaneous precipitation with post precipitation with aluminum sulfate. During the tests, the average influent BOD was 250 mg/liter, total phosphorus 8 mg/liter, and suspended solids 300 mg/liter. Simultaneous precipitation was the most economical process for the upgrade. Primary sedimentation could make the process more stable. Good nitrification, however, was not provided. Also, laboratory tests of combined municipal wastes and effluent from a cardboard mill indicated that the two wastes could be treated with no problems. (Small-FRC)
W81-01311

COMPARISON OF CONVENTIONAL INLAND SEWAGE TREATMENT PROCESSES WITH MARINE TREATMENT BY LONG OUTFALLS IN THE YUGOSLAV ADRIATIC REGION,
Taylor (John) and Sons, London (England).
A. J. Price.
Progress in Water Technology, Vol 12, No 1, p 263-277, 1980. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Outfall sewers, *Waste water treatment, *Oceans, Dilution, *Sewage treatment, Coliforms, Public health, Water pollution sources, Adriatic Sea, Yugoslavia.

The relative merits of providing sewage treatment by conventional inland means and by means of ocean dumping through long outfalls are considered. Satisfactory sewage treatment is necessary to protect the fisheries industry, encourage continued development and tourism in the area, and promote public health. Average figures are presented for effluent quality, and different acceptable methods of inland treatment and sludge treatment are outlined. Marine treatment, dilution and purification of sewage after screening and releasing into the water are outlined. After one half to two hours, most coliform bacteria die when exposed to sun and sea water. After two hours, the natural dilution of the sewage can be as great as 1000 fold. A properly designed marine treatment produces a satisfactory degree of treatment and should be considered for the Yugoslav Adriatic. (Small-FRC)
W81-01314

SCHEME FOR REMEDYING THE EFFECTS OF STORM SEWAGE OVERFLOWS TO THE TIDAL RIVER THAMES,
Thames Water Authority, London (England).
L. B. Wood, P. F. Borrows, and M. R. Whiteland.
Progress in Water Technology, Vol 12, No 3, p 93-107, 1980. 3 Fig, 2 Tab, 6 Ref, 4 Append.

Descriptors: *Oxygenation, *Storm runoff, Dissolved oxygen, Oxygen sag, Urban runoff, Storm drains, Fish kill, Rivers, Absorption, Thames River, United Kingdom.

Storm sewer overflows in London which coincided with certain tidal conditions caused severe dissolved oxygen depletions and fish kills. A solution to this situation is presented. Injection of pure oxygen using a pressure swing adsorption unit applied from a Vitox system on a barge which follows the minimum oxygen sag curve as it moves down river is proposed. One recent storm (1977) discharged a total of 3.9 million tons of storm sewage which resulted in a large fish kill. Dissolved oxygen curves for the day before the storm, the day of the storm, and six days after the storm indicated that insufficient oxygen killed the fish. Compensation by the addition of oxygen could be accomplished by oxygenating the sewage discharges as they pass through discharge stations, oxygenating tributaries, oxygenating power station cooling water, or injection of oxygen in the river at various points. Injection of oxygen by a moving barge will be tested in 1980. (Small-FRC)
W81-01316

TRADE EFFLUENT CONTROL IN LONDON,
Thames Water Authority, London (England). Metropolitan Public Health Div.
L. H. Thompson.
Progress in Water Technology, Vol 12, No 3, p 69-76, 1980. 8 Fig.

Descriptors: *Industrial wastes, *Regulation, *Costs, Industrial water, *Effluents, Waste water treatment, Cadmium, Heavy metals, Sludge disposal, London, United Kingdom.

Under current United Kingdom law, Water Authorities must control industrial effluents under a consent procedure. Industry must give advance notice of intent to discharge wastes into waterways, and Water Authorities can prohibit or limit the discharge of various substances. Effluent control is designed to protect the environment as well as the waste water treatment facilities and personnel. The volumes of industrial effluents in London today are presented. These vary from almost 100 cu m x 10 to the third power per working day for the brewing and food processing industry to less than 10 cu m x 10 to the third power per working day for textiles and tanning. The annual cost of treatment is less than 1500 British Pounds Sterling for the average industrial location. The control of heavy metals, particularly cadmium, in waste sludges is discussed. The current limit for cadmium in waste effluents is set at 1 mg/liter. When standards are met, the sludge can be disposed of on land. (Small-FRC)
W81-01317

INDUSTRIAL WASTE CONTROL PROCEDURES IN THE CITY OF LOS ANGELES, CALIFORNIA, U.S.A.,
Los Angeles Bureau of Sanitation, CA.
W. F. Garber.
Progress in Water Technology, Vol 12, No 3, p 23-55, 1980. 1 Fig, 7 Tab, 2 Ref, 2 Append.

Descriptors: *Industrial wastes, *Toxins, *Water pollution sources, Water pollution control, California, Cities, Regulation, Municipal wastes, Domestic wastes, Los Angeles, Non-point pollution.

The point source industrial waste control system of Los Angeles, California, which has been in operation since 1950, presently achieves almost complete control. This well-run, well organized industrial waste control program operating under city, state and federal controls is described. Control of non-point sources including domestic inputs or those which may infiltrate past manhole covers is to some degree impossible in Los Angeles. Regulations for the control of toxins must recognize these non-point background levels. If water quality standards are based on zero risk, the only way to control non-point emissions may be to eliminate the manufacture or use of the offending toxin. Minimum background levels for non-point sources are urged. Industrial waste sources in the Los Angeles area are detailed. (Small-FRC)
W81-01318

ECONOMICAL CONSIDERATIONS ON LOCAL OR CENTRALIZED WASTE WATER TREATMENT SYSTEMS,

Ruhrverband, Essen (Germany, F.R.).
For primary bibliographic entry see Field 6B.
W81-01319

WHICH PLANT EXPANSION IS THE MOST URGENT ONE IN A RIVER SYSTEM AND HOW TO DEVELOP A PRIORITY LIST,
Ruhrverband, Essen (Germany, F.R.).
For primary bibliographic entry see Field 6A.
W81-01320

USE OF MATHEMATICAL MODELS TO DERIVE A SYSTEM FOR CALCULATING THE ACCEPTANCE CAPACITY OF MARINE COASTAL WATERS. (UTILISATION DE MODELES MATHEMATIQUES DANS LA MISE AU POINT D'UNE METHODOLOGIE DE CALCUL DE LA CAPACITE D'ACCEPTATION DU MILIEU RECEPTEUR LITTORAL MARIN.),
Ingenieur General des Ponts et Chaussees, Grenoble (France).
For primary bibliographic entry see Field 5E.
W81-01321

INNOVATION SIMPLIFIES CONSTRUCTION AND TREATMENT,
O'Brien and Gere Engineers, Inc., Syracuse, NY.
B. N. Gidlow.
Water and Wastes Engineering, Vol 17, No 11, p 25-27, 31, November, 1980. 2 Fig.

Descriptors: *Waste water treatment, *Treatment facilities, Tertiary treatment, *Sewage treatment, Sludge disposal, Computers, Water pollution control, Lakes, Industrial wastes, Water pollution, Costs, Chlorination, Sludge treatment, Phosphorus, Syracuse(NY), New York, Onondaga Lake(NY).

The renovation of the Metropolitan Syracuse Sewage Treatment Plant has been completed, and some innovations of the facility and its expanded uses are described. The plant will help to improve the quality of Onondaga Lake through its new tertiary treatment procedures for industrial effluents. The $92 million expansion provided for installation of an extensive computer control system and for phosphate removal facilities which utilize industrial wastes. The facility has the world's longest prestressed concrete piles to support 26 new process structures, phosphate removal areas, and sludge disposal and waste beds. Pilot plant studies were used to arrive at the most suitable treatment procedures for the area, which finally included primary treatment, secondary treatment, chlorination, tertiary treatment, discharge and sludge handling units. Preliminary treatment areas and low lift pumps are also part of the on-site equipment. Sludge gas produced as a byproduct of sludge digestion is stored to fuel the plant's boiler. Sludge may also be picked up by trucks after dewatering for deposit at landfills. Plans for computer handling of storm overflow by remote control are currently being implemented at the new Syracuse facility. (Geiger-FRC)
W81-01325

ENERGY CONSERVATION UNITS REPLACE OIL AT SOUTHERLY WASTE WATER TREATMENT CENTER,
Pirnie (Malcolm), Inc., White Plains, NY.
For primary bibliographic entry see Field 5E.
W81-01336

WASTE WATER FRACTIONS ADD TO TOTAL TREATMENT PICTURE,
Water and Pollution Control Dept. Saskatoon (Saskatchewan).
R. Munch, C. P. Hwang, and T. H. Lackie.
Water and Sewage Works, Vol 127, No 12, p 49, 50, 53, 54, December, 1980. 7 Fig, 4 Tab, 11 Ref.

Descriptors: *Waste water treatment, *Sewage treatment, Saskatoon, Saskatchewan, Colloids, Phosphorus, Nitrogen, Grease, Metals, Canada.

Composition of raw sewage influent at the Saskatoon, Saskatchewan, treatment plant was determined by sampling during February, May, and October in order to obtain information for advanced treatment design. These results were compared with analyses of primary and secondary effluent and with raw sewage data from other cities. The composition of total and volatile solids was uniform throughout 1978; only the quantity changed. Saskatoon primary effluent contained 87% soluble solids, requiring maximum organic removal to be directed toward that fraction. Grease discharged from meat packing industries appears in the supra-colloidal fraction (83%). Grease removal after secondary treatment (using a rotating biological contractor) was about 88%. Distribution of organic nitrogen before and after primary treatment showed that nearly all removal occurred in the settleable and supra-colloidal fractions. Secondary treatment removed organic nitrogen from the supra-colloidal and soluble fractions. Overall removal of organic nitrogen was 74%. Phosphorus removal was accomplished during separation of the settleable fraction (22% of raw sewage). Secondary effluent contained 93% of the soluble phosphorus. BOD, COD, and total organic carbon studies produced inconclusive results. Copper and chromium were entirely within the settleable fraction. Zinc appeared in the supra-colloidal fraction and was not removed by primary or secondary treatment. (Cassar-FRC)
W81-01341

STATISTICAL COST FUNCTION DEVELOPED FOR SEWER LINES,
Johns Hopkins Univ., Baltimore, MD.
S. H. Hanke, and R. W. Wentworth.
Water and Sewage Works, Vol 127, No 12, p 55, December, 1980. 3 Ref.

Descriptors: *Construction costs, *Pipelines, Costs, Sewerage, Conveyance structures, Estimating, *Waste water lines, Cost analysis.

Since the average cost per unit of pipeline decreases as pipeline diameter increases, an equation has been developed to express this relationship for use in cost estimates for waste water lines. This formula relates total costs to pipeline diameter, flow rate, and several constants. For example, if pipeline capacity is increased by 100%, it is 95% certain that construction costs will increase by 36-39%. (Cassar-FRC)
W81-01342

CONTINUOUS MONITORING FOR SEWAGE-TREATMENT PURPOSES,
Severn-Trent Water Authority, Birmingham (England). Tame Div.
For primary bibliographic entry see Field 5A.
W81-01345

MODELLING THE DYNAMICS OF THE ACTIVATED SLUDGE WASTE WATER TREATMENT PROCESS IN TERMS OF THE CARBON VARIABLE,
Ugine-Kuhlmann, Pierre-Benite (France).
S. Perdrieux, and N. Therien.
Water Research, Vol 14, No 9, p 1333-1344, September, 1980. 16 Fig, 2 Tab, 19 Ref.

Descriptors: *Waste water treatment, *Activated sludge, *Mathematical models, Carbon, Organic compounds, Kinetics, Suspended solids, Biodegradation, Microorganisms, Biochemical oxygen demand, Sludge.

Carbon as a process variable was used to characterize the dynamic nature of the activated sludge process in terms of the soluble organic carbon for the substrate and the suspended solid organic carbon for the biomass. Intermediate carbon compounds stored in the cells were also considered in the mathematical models developed by the authors. This model utilized the concentration of organic substrate, the concentration of cellular material, and the concentration of products stocked in the cells for the aeration unit of the activated sludge process. The substrate and biomass concentrations predicted by this model are compared to simpler models based on the growth kinetic concept using Monod or two-phase expressions and to earlier work performed by the authors. The failure of the Monod model to predict some important aspects of the unsteady state operation is discussed. (McKeon-FRC)
W81-01347

THE ROLE OF THE COBALT CATALYST IN THE UNSTEADY-STATE TEST,
Simon-Hartley Ltd., Stoke-on Trent (England).
W. S. Robertson.
Water Pollution Control, Vol 79, No 4, p 487-495, November, 1980. 4 Fig, 1 Tab, 11 Ref.

Descriptors: *Aeration, *Unsteady state test, Cobalt, Copper, Dissolved oxygen analyzers, Oxygenation, Analytical techniques, Testing procedures, Equipment, Evaluation.

The unsteady-state test, used in testing aeration equipment, exhibits non-reproducible results. Preliminary comparisons with several methods of deoxygenation and dissolved oxygen measuring methods indicated that chemical interference was probably the cause of discrepancies. Tests with copper sulfite catalyst showed that it was suitable for the sulfite oxidation method, but not for the unsteady-state test. Tests with cobalt chloride showed the reverse situation. Chemical interference was absent at 5C, but more important at 15C and above. The cobalt catalyst appeared to be complexed and present as a precipitate, taking part in reactions and having a relatively high oxygen demand. However, its rate of reaction was slow and unpredictable, being affected by water composition and temperature. (Cassar-FRC)
W81-01357

UNUSUAL BEHAVIOUR OF CILIATED PROTOZOA IN A SECONDARY SETTLEMENT TANK,
Yorkshire Water Authority (England). Southwestern Div.
G. Wheale, and D. J. Williamson.
Water Pollution Control, Vol 79, No 4, p 496-500, November, 1980. 6 Fig, 4 Tab, 4 Ref.

Descriptors: *Activated sludge, *Protozoa, *Water pollution sources, Halifax(England), Effluents, *Waste water treatment, Sludge treatment.

During a period of high solids loading in the Halifax, Yorkshire, treatment plant, unusual white streaks (maximum size, 3 meters by 1 meter) were observed resting on the sludge blanket in a secondary settlement tank. This material was composed of large flocs about 1 mm diameter. Microscopic examination revealed that these flocs were spherical colonies of a peritrich similar to Carchesium polypinum. However, this species had faintly striated pellicles and clearly segmented stalks, different characteristics from those of Carchesium polypinum. Rotifers were also seen. Addition of a synthetic cationic polymer to assist settlement caused a release of flocculated colonies to the surface of the tank. The detached colonies may comprise a major proportion of the suspended solids in effluent from this plant. (Cassar-FRC)
W81-01358

ANAEROBIC CONTACT FILTER PROCESS: A SUITABLE METHOD FOR THE TREATMENT OF VEGETABLE TANNING EFFLUENTS,
National Environmental Engineering Research Inst., Kanpur (India). Zonal Lab.
H. C. Arora, and S. N. Chattopadhya.
Water Pollution Control, Vol 79, No 4, p 501-506, November, 1980. 2 Fig, 2 Tab, 3 Ref.

Descriptors: *Filtration, *Tannery wastes, *Anaerobic digestion, Industrial wastes, Chemical wastes, *Waste water treatment, Sludge digestion, Contact filter process.

An anaerobic contact filter process was further tested as a method of treating vegetable tanning effluents. Batch feeding simulated actual operating conditions in local tanneries. Retention periods varied from 12 hours to 144 hours. The influent was a mixture of liming liquor, exhaust tan liquor, and deliming liquor. In the initial stages there was

a progressive increase in precentage removal of COD to a maximum of 80-90%, which leveled off after 54 days (retention period 144 hours). However, when retention times were reduced to 48 hours on Filter I and 24 hours on Filter II, pollutant removal decreased initially, and gradually increased over a 2-week period to the 80-90% steady state. BOD and tanning levels behaved similarly. Subsequent reductions in retention time (to 24 hours for Filter I and 12 hours for Filter II) did not significantly affect removal of organic materials. Advantages over the conventional lagooning systems are smaller land area, smaller capital costs, no sludge disposal necessary, and production of a usable combustible gas. (Cassar-FRC)
W81-01359

THE USE OF ULTRA HIGH RATE DUAL-MEDIUM FILTRATION AND DISSOLVED-AIR FLOTATION FOR MAINTENANCE OF CONSISTENT EFFLUENT STANDARDS AT HIGH LOADINGS,
Water Pollution Research Lab., Stevenage (England).
P. H. Jago, J. A. Ovens, and P. E. Hale.
Water Pollution Control, Vol 79, No 4, p 442-451, November, 1980. 4 Fig, 3 Tab, 7 Ref.

Descriptors: *Filtration, *Flotation, Dissolved air flotation, Suspended solids, Waste water treatment, *Sewage treatment, Separation techniques.

Dissolved-air flotation and ultra high rate dual media filtration (sand, anthracite) are processes which can maintain effluent quality from secondary settlement tanks during periods of sudden increases in flow of sewage to the plant. These two pilot plant systems were operated in parallel from August, 1977, to June, 1978, at the Fengate sewage treatment works in a comparison study. The dissolved-air flotation process produced a final effluent containing not more than 30 mg per liter suspended solids from a secondary settlement tank effluent containing up to 550 ml per liter. The filter, unable to handle these high loads, could produce satisfactory effluent from influent levels up to 150 mg per liter at a flow of 6.5 mm per second and 200 mg per liter at 3.25 mm per second. The pilot plant filter required frequent backwashing, but remained clear of biological growth. (Cassar-FRC)
W81-01360

USE OF WATER HYACINTHS IN WASTE WATER TREATMENT,
Maryland Univ., Eastern Shore, Princess Anne.
G. C. Gupta.
Journal of Environmental Health, Vol 43, No 2, p 80-82, September/October, 1980. 30 Ref.

Descriptors: *Water hyacinth, *Waste water treatment, *Reviews, Publications, Coliforms, Sewage, Biochemical oxygen demand, Nitrogen, Phosphorus.

A literature review is presented on the use of water hyacinths in sewage and waste water treatment. Water hyacinths have been effective in removing algae, fecal coliforms, suspended particles, trace toxic metals, organics, and many other dissolved impurities from waste water. Water hyacinths are classified as an aquatic pest, but culturing hyacinths in a sewage lagoon system can reduce BOD5 up to 95%, total suspended solids up to 90%, and also reduce nitrogen, phosphorus, heavy metals, and pesticides. Biological, chemical, and physical factors combine to remove contamination. Five point one acres of water hyacinths are needed for 1 mgd throughput to remove 80% of the nitrogen and 44% of the phosphorus. Hyacinths are effective and cheap where land is available inexpensively. (Small-FRC)
W81-01361

TOWNSHIP OF TEMAGAMI: ONE ALTERNATIVE FOR SERVICING A NORTHERN COMMUNITY,
Ontario Ministry of the Environment, Toronto.
B. J. Cooper.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 140-149. 1 Tab, 3 Ref.

Descriptors: *Pressure sewers, *Ontario, *Cold regions, *Sewage disposal, Environmental sanitation, Sewage lagoons, *Sewage treatment, Sewers, Canada, Pipes, Public utilities, Cost analysis, Cost comparisons, Operating costs.

A low pressure, shallow buried, thermally insulated pressure sewer system was constructed to correct the serious environmental and public health problems at the Township of Temagami. Temagami, which is located approximately 460 km north of Toronto, has approximately 150 dwellings. The combination of 1300 freezing degree days Celsius and the location of the community on the Precambrian Shield resulted in very expensive servicing. Since most of the capital costs of construction were subsidized, the system with the cheapest operating cost per annum was used. The sewer system was composed of a styrofoam 'frost box' with the transmission main located in the box and buried only to a typical depth of 1.2 m. The final system involved 8,250 m of pipe, 30 valve chambers, a heat tracing system, 160 pumping units, and home service connections. A waste stabilization pond was constructed at a cost of approximately $304,000/ha and was designed for a 180 day retention period. From the pond, effluents are treated for phosphorus removal and then are discharged into the lake. Cost comparisons of this system and three more conventional systems are given along with a list of factors for consideration in the evaluation of pressure sewers versus gravity sewers. (See also W81-01381) (Seigler-IPA)
W81-01389

MODIFIED LOW PRESSURE COMMUNAL SEWAGE DISPOSAL SYSTEMS,
Sturgeon Health Unit, St. Albert (Alberta).
K. W. McAmmond.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 477-483. 3 Fig.

Descriptors: *Sewage disposal, *Alberta, *Sewage effluents, *Septic tanks, Sewage sludge, Sewage lagoons, Sanitary engineering, Liquid wastes, Rural areas, Sewage treatment, Environmental sanitation, Water pollution sources, Plastic pipes, Pumping.

A modified collection system using plastic pipe and a small lagoon is recommended as an alternative to present ineffective sewage disposal systems in Alberta. This modified low pressure communal sewage disposal system disposes of liquid effluent in a safe and reasonably economical manner for hamlets, suburban, and rural residential areas. The system uses septic tanks, automatically controlled sewage pumps, and plastic pipes. Raw sewage flows by gravity into a two compartment septic tank at each home where the liquid separates from the solid and the liquid flows into the second compartment. The liquid is then pumped through a plastic pipe into collector mains that convey the liquid to a lagoon located outside of the community. The sewage pumps are automatically activated by the liquid level in the septic tank. A checkvalve prevents backflow from the main. No problems with blockage or plugging have occurred where this system has been installed; the septic tanks are pumped out every second year. System benefits include protection from diseases, safe disposal of ground seepage water, increased real estate values, increased tax revenues through growth and higher assessments, safety for wells, and lowering of the water table that can eliminate the need for basement sump pumps. A recent cost estimate from the Hamlet of Busby, where there are 30 connections, is $110,900. (See also W81-01381) (Seigler-IPA)
W81-01409

THE TREATMENT OF WOOLSCOUR EFFLUENT - I. REMOVAL OF COLLOIDAL DIRT,
Department of Scientific and Industrial Research, Petone (New Zealand). Industrial Processing Div.
C. N. S. McLachlan, D. K. W. Smith, and R. J. Webb.
Water Research, Vol 14, No 7, p 729-733, July, 1980. 8 Fig, 2 Tab, 10 Ref.

Descriptors: *Wool grease, *Industrial waste, *Waste water treatment, *Flocculation, Polyelectrolyte, Flotation, Pilot plants, Centrifuge, Sludge, Sedimentation.

Removal efficiencies of colloidal dirt in woolscour effluent were studied using polymeric flocculants, dissolved-air flotation and sedimentation. The effectiveness of the polymers was tested in both laboratory and fullscale experiments. Results indicated that up to 80% of the dirt in the liquor was removed as a 20% weight to volume ratio solids sludge. This sludge was capable of further dewatering to 45-50% solids using a solid bowl centrifuge. There was no evidence of dirt re-deposition on the wool as a result of the use of the polyelectrolyte, nor was the use of the polyelectrolyte found to have a measurable effect on centrifugal grease recovery. A comparison of the results obtained using the settling tank and the flotation tank indicated that under normal circumstances a suitably designed settling tank provided the simplest method of solids removal when readily settlable solids and colloidal material were removed together. (McKeon-FRC)
W81-01413

THE TREATMENT OF WOOLSCOUR EFFLUENT-II. GREASE REMOVAL BY ALCOHOL EXTRACTION,
Department of Scientific and Industrial Research, Peton (New Zealand). Industrial Processing Div.
C. N. S. McLachlan, D. K. W. Smith, and R. B. Fieldes.
Water Research, Vol 14, No 7, p 735-740, July, 1980. 6 Fig, 5 Tab, 15 Ref.

Descriptors: *Solvent extraction, *Wool grease, Separation techniques, Industrial wastes, Waste water treatment, *Alcohols, Oily water, Flocculation, Polyelectrolytes, Biochemical oxygen demand, Pilot plant.

The use of pentanol in combination with a flocculant to crack a woolgrease-in-water emulsion and the subsequent separation and recovery of grease from the remaining colloidal dirt are described. The addition of 4-5% pentanol together with a synthetic polymer, Magnafloc 455, enabled a rapid separation of the de-emulsified grease and dirt from the liquor. The grease is then separated from the colloidal dirt, followed by steam stripping of the effluent streams to recover the pentanol. Grease removals from the liquor averaged 85-95% and BOD reductions averaged 50-75% in both laboratory and pilot scale trials. An effluent free of suspended solids and readily amenable to biological treatment was produced. (McKeon-FRC)
W81-01414

SEPARATING SOLIDS FROM LIQUIDS,
Courtaulds Ltd., London (England). (Assignee).
D. C. Woodward.
U.S. Patent No 4,197,180, 6 p, 4 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 993, No 2, p 616-617, April 8, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Water purification, Electrolysis, Electrodes, Carbon, Bubbles, Activated sludge, Equipment, Electroflotation.

In a process for the separation of solid particles from an aqueous liquid by electroflotation various effluent liquids can be clarified, surplus activated sludge can be concentration and protein can be recovered. The apparatus for carrying out the separation comprises a tank containing an anode and a cathode, at least one of these electrodes being formed from carbon fibres. The tank has an inlet for the aqueous liquid containing solid particles and an outlet for clarified liquid and means for removing solid particles which have been carried upwardly in the tank. The electrodes preferably comprise carbon fibres set in an electrically-insulating matrix and having exposed ends of carbon

fibres substantially throughout the length of the electrode. (Sinha-OEIS)
W81-01419

METHOD FOR MINIMIZING THE ORGANIC WASTES IN AQUEOUS PRODUCT STREAMS PRODUCED IN LIQUID-LIQUID EXTRACTION PROCESSES,
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). (Assignee).
W. Ochsenfeld, and J. Schon.
U.S. Patent No 4,197,195, 6 p, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 2, p 621, April 8, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Organic wastes, Absorption, Resins, Recycling, Distillation, Regenerating solvent, Regeneration.

A method is provided for minimizing the organic waste found in an aqueous process stream of products and refined products from a liquid-liquid extraction process. The aqueous process stream contains small quantities of interfering substances in the form of an organic extraction agent and decomposition products of the extraction agent and is treated with an agent which selectively, practically quantitatively and reversibly sorbs the interfering substances. This agent is a macroporous sorption resin based on polystyrene cross-linked with divinyl benzene. The sorption resin, after being charged with the interfering substances, is regenerated by being brought into contact with a regenerating solvent. The regenerating solvent is then separated from the sorption resin and subjected to a distillation. The distillate consists of pure solvent and is put back into circulation to regenerate sorption resin. The extraction agent obtained as the distillation residue is recirculated, after dilution with a dissolving diluent, and returned into circulation in the extraction process. (Sinha-OEIS)
W81-01420

SHIPBOARD BLACKWATER PHYSICAL/CHEMICAL TREATMENT SYSTEM,
Office of the Secretary of the (Navy). Washington, D.C. (Assignee).
C. S. Alig.
U.S. Patent No 4,197,200, 5 p, 1 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 622, April 8, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Water purification, Separation techniques, Disinfection, Ozone, Equipment, Incineration, Boats, Water supply, Shipboard systems.

An automatic dual-mode shipboard waste water treatment system employs ozone for disinfection of the primary effluent. Solids are removed and pumped to the ship's boiler or other equipment for incineration, while the liquid waste is pumped through a series of ozone reactors and then to a holding tank from which it is discharged overboard, after accumulating to a predetermined level. The system operates continuously by recirculating the effluent, during low flow periods, between a second holding tank and the ozone reactors. (Sinha-OEIS)
W81-01422

BIOLOGICAL SEWAGE TREATMENT PLANT,
Przedsiebiorstwo Instalacjiprzemyslowych, Katowice (Poland). (Assignee).
R. Przybylowicz, L. Narbutt, and J. Stepien.
U.S. Patent No 4,197,202, 7 p, 11 Fig, 17 Ref; Official Gazette of the United States Patent Office, Vol 993, No 2, p 623, April 8, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Sewage treatment, *Biological treatment, Equipment, Aeration, Flow, Absorption, Microorganisms, Oxygen.

A multi-stage biological sewage treatment plant includes a tank of cylindrical shape, divided concentrically by means of vertical annular stationary screens, forming chambers, and by means of movable annular screens forming sections performing various technological functions. Floats located in the walls of the movable screens ensure aeration of the liquid with gas. Regular aeration and mixing of the whole contents of liquid in the chambers ensure an optimication of hydraulic parameters and for maintaining the whole mass contained in the chamber in a state of suspension. This enables absorption of impurities contained in the sewage by the cell mass of microorganisms being the active sediment, whereas the factor stimulating the growth of microorganisms is the amount of oxygen fed by the aerating devices. (Sinha-OEIS)
W81-01423

WATER RECYCLING WITH SOLIDS AND FOAM REMOVAL,
The Water-Cyk Corp., Vienna, VA. (Assignee).
E. P. Toms.
U.S. Patent No 4,197,597, 9 p, 11 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 754, April 15, 1980.

Descriptors: *Patents, *Waste water treatment, *Domestic wastes, *Water reuse, Separation techniques, Filtration, Equipment, Hydraulics.

A water economizing system for new or existing buildings is described where the waste lines of lavatory sinks, showers and clothes washing machines are connected to a storage reservoir for the accumulation of the water. This accumulated water is filtered and treated and then used for the operation of water closets of toilets. The storage reservoir provides for the removal of solids and foam by flushing action at the top and subsequently for the gravitational separation of solids which are periodically flushed from the bottom of the reservoir into the sewer. The pumping action which delivers the accumulated water to the water closets of toilets may be hydraulically operated by a portion of the water drained to the storage reservoir. (Sinha-OEIS)
W81-01424

5E. Ultimate Disposal Of Wastes

DISPERSION AND WEATHERING OF CHEMICALLY TREATED CRUDE OILS ON THE OCEAN,
Chevron Oil Field Research Co., La Habra, CA.
C. D. McAuliffe, J. C. Johnson, S. H. Greene, G. P. Canevari, and T. D. Searl.
Environmental Science and Technology, Vol 14, No 12, p 1509-1518, December, 1980. 7 Fig, 5 Tab, 16 Ref.

Descriptors: *Dispersion, *Oil spills, *Water pollution control, Oily water, Surface waters, Oceans, Atlantic Ocean, Oil pollution, Oil wastes, Water pollution, Disasters, Water pollution sources, Control systems, Weathering, Emulsions.

Means to control oil spills were tested off New Jersey, at four experimental spills using Murban and La Rose crude oils. Immediately after the spill was made, two slicks were sprayed aerially with a self-mix dispersant from a pod and spray booms mounted above the skis of a helicopter. The other two slicks were sprayed similarly 2 hr after the spills were made. At 20-60 min after dispersion, the average total oil under the immediately treated slicks at 1, 3, 6, and 9 m were 0.7, 0.7, 0.3, and 0.2 mg/L for La Rose crude and 3.1, 2.4, 0.5, and 0.4 mg/L for Murban crude. At 20-45 min after treatment the highest concentrations were 3 mg/L for La Rose and 18 mg/L for Murban. In those spills treated 2 hr after spill the concentrations of oil were only slightly higher. Visual and photographic evidence indicated that Murban crude oil treated immediately was almost completely dispersed. For La Rose, immediate treatment resulted in about half the oil being immediately dispersed. Oil removed from the influence of wind by emulsification will not travel as far, and this will reduce the likelihood of oil stranding or entering biologically sensitive areas. Murban crude dispersion weathered more rapidly than La Rose, reflecting Murban's lower viscosity and perhaps its smaller droplet sizes. (Baker-FRC)
W81-01259

HANDLING HAZARDOUS WASTES,
Battelle-Columbus, OH.
J. A. Gurklis, and L. E. Vaaler.
Industrial Finishing, Vol 56, No 12, p 14-21, December, 1980. 1 Fig, 1 Tab, 4 Ref.

Descriptors: *Waste disposal, *Landfills, *Waste treatment, *Heavy metals, Sludge disposal, Industrial wastes, Sanitary engineering, Public health, Legal aspects, Costs, Waste water treatment, Sludge, Clean Air Act, Ultimate disposal, Potable water, Leaching, Monitoring, Incineration.

Under the Resource Conservation and Recovery Act (RCRA) of 1976 stringent regulations were imposed on the disposal of toxic wastes. The two types of wastes to be regulated under the RCRA were identified by their characteristics of ignitability, corrosivity, reactivity, and extraction procedure toxicity or by non-specific source listings. Waterborne and air emission wastes are regulated under the Clean Water Act, Clean Air Act and Safe Drinking Water Act. Chemical treatment is often employed for handling heavy metals, acids and alkalies, cyanide and other noxious gases. In the United States, the burden of waste treatment rests with the waste generator, while in Europe many government-owned facilities are operated for the treatment of hazardous wastes. After wastes are treated, ultimate disposal of wastes can take place at landfills or by incineration. Hazardous wastes landfills are engineered to avoid contamination of groundwater through leaching. Some landfills are covered with special liners, which are resistant to rodent and root penetration and which help contain toxic wastes. Leachate collection must be monitored, and other precautions are taken to secure the landfill. Centralized stations exist in Europe for the collection and disposal of paint wastes, oils and other toxic substances. Some costs of toxic waste treatment and disposal, as well as response of industry in attempting to recycle wastes and minimize this economic burden are discussed. (Geiger-FRC)
W81-01263

ANAEROBIC SLUDGE DIGESTION PROCESS WITH PROLONGED DIGESTION TIME FOR THE SOLID SUBSTANCES AND SHORTENED FOR THE SLUDGE LIQUOR,
Complex Research and Design Inst. for Communal Economy, Sofia (Bulgaria).
Ch. Dimovski.
Progress in Water Technology, Vol 12, No 3, 307-313, 1980. 1 Fig, 2 Ref.

Descriptors: *Anaerobic digestion, *Sludge treatment, *Wastewater treatment, Sludge digestion, Separation techniques, Settling basins, Aeration, Specifications.

A system for anaerobic sludge digestion which consists of a homogeneous digester and a sludge liquor separator was developed after laboratory and pilot studies. It works in a manner similar to an activated sludge system, as it utilizes aeration and settling tanks. The sludge is passed through the separator, and the solids are returned to the digester. Thus, the digestion time for the solids is lengthened. Since the liquor is separated quickly, its digestion time is shortened. The system is described, and formulas are provided for estimating technological parameters of the system, including: digester and separator capacities, average digestion time for solid substances and sludge liquor, quantity of discharged digested sludge and sludge liquor, and return sludge volume. The overall capacity of the system is 60-70% smaller than that of single stage digesters without sludge liquor separation, and 30-40% smaller than those of two-stage digesters. (Small-FRC)
W81-01306

DESIGN DATA FOR GRAVITY THICKENERS,
Water Pollution Lab., Stevenage (England).
M. J. D. White, C. F. Lockyear, and E. J. Tomlinson.
Progress in Water Technology, Vol 12, No 3, p

279-285, 1980. 5 Fig, 1 Tab, 1 Ref.

Descriptors: *Sludge treatment, Dewatering, Gravity, *Centrifugation, Analytical techniques, Estimating, Gravity thickeners, Thickenability, Design data.

A rapid test of thickenability was developed as method of characterizing sludge and as an aid in the design of full-scale thickeners. In this rapid test, a low-speed centrifuge is used to simulate the compressive effect of a deep sludge blanket. The compressibility of the sludge is determined by varying the centrifugal acceleration from 5 to 100 g. Thus, the effect of the blanket depth on the ultimate concentration of solids achievable in a full-scale thickener can be estimated. A built-in stroboscope is used to determine rate of thickening. Comparisons of predicted solids concentrations with those achieved in full-scale thickeners showed good agreement. The centrifuge predicted slightly higher concentrations, which can be explained by the fact that the sludge in the full-scale thickeners had not reached its ultimate solids concentration. (Small-FRC)
W81-01308

EVOLUTION OF PRIMARY SLUDGE DURING THICKENING,
Paris-6 Univ. (France). Lab. de Geodynamique.
F. Abosamra.
Progress in Water Technology, Vol 12, No 3, p 297-305, 1980. 15 Fig.

Descriptors: *Sludge treatment, *Fermentation, *Anaerobic bacteria, Microorganisms, Dewatering, Confined water, Compressibility.

Three types of sludge from waste water treatment plants were thickened for seven days in a gravity thickener. Intense fermentation took place the first day, and BOD, COD, ammonia, and volatile acids increased quickly. The bacteria and protozoa in the sludge form the substrate for anaerobic acidifying bacteria which use fresh sludge particles. The conjunction of the two substrates stimulates the development of the bacterial biomass. The fermentation changes the compressibility of the sludge because of the development of a thin layer of bacteria on the surface which retains free water. Thus, fermentation changes the filterability and dewaterability of the sludge. The lime-ferric chloride and polyelectrolyte demand of the sludges increased with fermentation. (Small-FRC)
W81-01309

COMPARATIVE INVESTIGATIONS OF DIFFERENT METHODS TO CONCENTRATE WASTE ACTIVATED SLUDGE,
Authority for Waste Water, Hanover (Germany, F.R.).
D. Kansy.
Progress in Water Technology, Vol 12, No 3, p 287-296, 1980. 6 Fig, 7 Tab, 8 Ref.

Descriptors: *Sludge treatment, Dewatering, *Separation techniques, *Activated sludge, Flotation, Gravity, On-site investigations, Evaluation, Gravity thickeners, Decanters, Dissolved air flotation.

Gravity thickening, dissolved air flotation, nozzle-type separators, and decanters were compared as methods to concentrate waste activated sludge. At the Hannover-Herrenhausen plant, the four methods were used in parallel for activated sludge with different sludge loading rates. Flotation or nozzle-type separation concentrated the sludge to 3-6%. Gravity thickening to 2.5-4% was possible with high loaded sludges only. Decanters concentrated to 8-15%. A good quality of clarified effluent (0.01-0.05%) was reached upon thickening by flotation, but effluent quality was poorer (0.10-0.20%) with nozzle-type separation. Decanters reached effluent values of 0.05-0.15% depending on the quality of the polymer used. Nozzle-type separation had the highest energy costs and the highest stress on the flocs. Centrifuges did not reduce the quality of the effluent. (Small-FRC)
W81-01310

LOW COST OF PROVISION OF ANAEROBIC DIGESTION,
Severn-Trent Water Authority, Birmingham (England).
G. P. Noone, and C. E. Brade.
Progress in Water Technology, Vol 12, No 3, p 315-329, 1980. 5 Fig, 2 Tab, 12 Ref.

Descriptors: *Anaerobic digestion, *Costs, Heating, Surveys, On-site tests, Design, Performance, Uprating, *Sewage sludge, Sludge treatment, Sludge disposal.

A survey was carried out to examine the significant variations in apparent design and operation of some existing Severn-Trent Water Authority digesters. These results, combined with literature information on pilot and full-scale plant operation, indicate that uprating of an existing plant should be the cheapest method of providing additional treatment capacity. When mixing and heating are adequate, there is increased reliability of digestion at a high rate. At the Sutton-in-Ashfield site, a digester of nominal volume 1373 cu m and conventional design was modified to provide a standby gas compressor. There has been an increase in solids loading and a reduction in detention time. At Shirebrook, one of three 400 cu m tanks was converted into a heated primary digester at a cost of $29,000. Although results are preliminary at Shirebrook, increased anaerobic digestion is possible by uprating existing plants, perhaps utilizing existing tanks. The new digestion plant should be on the basis of smaller volumetric provision of the primary reactor related to examination of the whole sludge flow sheet both prior to and post primary digestion. (Small-FRC)
W81-01312

USE OF MATHEMATICAL MODELS TO DERIVE A SYSTEM FOR CALCULATING THE ACCEPTANCE CAPACITY OF MARINE COASTAL WATERS. (UTILISATION DE MODELES MATHEMATIQUES DANS LA MISE AU POINT D'UNE METHODOLOGIE DE CALCUL DE LA CAPACITE D'ACCEPTATION DU MILIEU RECEPTEUR LITTORAL MARIN.),
Ingenieur General des Ponts et Chaussees, Grenoble (France).
M. de Rouville, G. Chevereau, and B. Quetin.
Progress in Water Technology, Vol 12, No 1, p 279-300, 1980. 6 Fig, 16 Ref.

Descriptors: *Methodology, *Diffusion, *Municipal wastes, Ocean currents, Oceans, Jets, Flow, Convection, Water pollution effects, Mediterranean, Mathematical models, Waste water disposal, *Sewage disposal.

A universal methodology is established to determine the dispersion of urban sewage discharged into marine coastal waters. Three separate programs are employed, which make it possible to simulate the essential phenomena of marine diffusion effluents: the changes in form of jets and plumes discharged in the presence of a thermal stratification, the latter being simulated based on meteorologic data; changes in effluent entrained by a surface current (convection, spreading, lateral and vertical diffusion), and bacterial autopurification. The use of this methodology in studies on the French Mediterranean is discussed, and case histories are presented. The model can be used to determine the effect of a particular discharge, and also to determine the capacity of the coastal waters to absorb polluting discharges. (Small-FRC)
W81-01321

MOVEMENT OF CHLORIDE IN A SOIL WITH VARIABLE CHARGE PROPERTIES: I. CHLORIDE SYSTEMS,
Sydney Univ. (Australia). Dept. of Soil Science.
K. Y. Chan, H. R. Geering, and B. G. Davey.
Journal of Environmental Quality, Vol 9, No 4, p 579-582, October/December, 1980. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Soil chemical properties, *Chlorides, *Leaching, Leachate, *Landfills, Hydrogen ion concentration, Adsorption, Movement, Model studies, Laboratory tests, Kinetics, Cation exchange, Neutralization, Anion adsorption, Ammonia, Path of pollutants.

Chloride solutions synthesized to simulate leachate of a treated sanitary landfill were run through columns filled with xanthic ferralsol subsoil in laboratory experiments designed to measure the movement of chloride. Chloride movement did not adhere to the miscible displacement equation or other more complicated models. The positive charge of the soil was more dependent upon pH and ionic strength of the leaching solution. When the alkaline synthetic leachate was poured through the column, the amount of positive charge was enhanced due to the greater ionic strength of the leachate relative to the soil solution. Smaller increases in positive charge were attributed to reductions in pH caused by cation exchange from the leachate front. As the alkaline leachate caused the soil pH to increase to over 9.0, the positive charge was neutralized by adsorption of hydroxide. These findings illustrate how the chloride outflow curve will deviate from theory under conditions where the positive charges of the soil are changed by the leachate solution. New kinetic models are needed to describe the alterations in the soil's charge properties induced by the solutions moving through it before more advanced theories of miscible displacement can be applied to this type of situation. (Geiger-FRC)
W81-01323

MOVEMENT OF CHLORIDE IN A SOIL WITH VARIABLE CHARGE PROPERTIES: II. SANITARY LANDFILL LEACHATE,
Sydney Univ. (Australia). Dept. of Soil Science.
K. Y. Chan, H. R. Geering, and B. G. Davey.
Journal of Environmental Quality, Vol 9, No 4, p 583-586, October/December, 1980. 3 Fig, 1 Tab, 13 Ref.

Descriptors: Movement, *Chloride, *Leachate, Anions, *Landfills, Waste disposal, Simulated rainfall, Soil chemical properties, Cations, Soils, Fluctuations, Ion transport, Leaching, Model studies, Hydrogen ion concentration.

The effects of a lime-treated sanitary landfill leachate on the movement of chloride through a column filled with the subsoil of a xanthic ferralsol were examined in laboratory tests. The displacement of the leachate solution in the column by distilled water was also studied to simulate the effects of rainfall upon the movement of chloride in the landfill soil. Deviations from the Nielsen-Biggar miscible displacement equation were observed when chloride movement was monitored. This was attributed to fluctuations in the level of positive charge carried by the soil caused by changes in ionic strength and pH. Analysis of the leachate showed the presence of carboxylate groups which competed with chloride anions for sites on the positively charged oxidic surfaces. Chloride was displaced at the end of the leachate treatment when distilled water was added, even though the pH was greater than 9. A net desorption of chloride of 0.69 milliequivalents/100 g was measured, showing that this anion cannot be ignored in models of salt solution movement through charged oxidic soils. (Geiger-FRC)
W81-01324

ENERGY CONSERVATION UNITS REPLACE OIL AT SOUTHERLY WASTE WATER TREATMENT CENTER,
Pirnie (Malcolm), Inc., White Plains, NY.
J. J. Stankunas.
Water and Sewage Works, Vol 127, No 11, p 26, 27, 56-58, November, 1980. 3 Fig, 5 Tab.

Descriptors: *Waste disposal, *Incineration, Ultimate disposal, Skimming, Cleveland, *Waste water treatment, Sewage treatment, Fuels, Disposal, Sludge disposal, Energy conservation.

Sewage skimmings (grease, oil, soap, vegetable matter), are burned as part of an energy conservation program at Cleveland's Southerly Waste Water Treatment Center. This procedure eliminates the disposal of skimmings and liquid wastes,

saving process and capital costs. Skimmings are collected, pumped to storage tanks, decanted, macerated, and heated in preparation for burning in combination with fuel oil. The skimmings-fired boiler at a steam capacity of 45,000 pounds per hour, operating 95% of the time, will produce 58% of the system's requirements and save 2.75 million gallons of fuel oil annually. The steam produced is used for sludge conditioning. Other energy conservation measures in this plant are heat pumps to transfer heat from effluent to provide heat for the 13 buildings (savings, 350,000 gallons of fuel oil annually) and energy wheels to recover heat in the building exhaust system during winter (10.3 gallons per hour savings). Heat obtained by incinerating sludge is used to make steam. Total energy savings in this project are 4.2 million gallons of No. 2 fuel oil annually. (Cassar-FRC)
W81-01336

FLUIDIZED-BED INCINERATION OF SEWAGE SLUDGE AT ESHER, 1976-1978,
Thames Water Authority, London (England). Southern Div.
R. Dickens, B. Wallis, and J. Arundel.
Water Pollution Control, Vol 79, No 4, p 431-441, November, 1980. 2 Fig, 4 Tab.

Descriptors: *Sludge treatment, *Incineration, Disposal, *Sludge disposal, Esher(England), Fluidized beds.

Experiences during 2-1/2 years of operating a sludge dewatering and incineration plant at Esher indicated that the fluidized-bed incinerator is reliable and easy to start up and shut down. Although this type of incinerator has a low manpower requirement, a skilled maintenance staff is necessary for efficient operation. The plant processes sludge from a city of 114,000 as well as sludge imported from neighboring communities. Sludge is dewatered in coil-filter vats, then incinerated in a reactor 9.98 meters high. This contains a fluidized, heated sand bed which breaks up sludge into small, quickly-combustible particles. Ash is removed from the effluent gas as a 3% slurry and settled in drying beds. Operational problems included corrosion of scrubber-recirculating pumps and ash transfer pumps by the ash slurry, repairs on sonic-spray equipment, decline in effluent quality, ash disposal, and noise complaints by residents. (Cassar-FRC)
W81-01344

THE DEVELOPMENT OF MARINE POLLUTION CONTROL IN HONG KONG,
D. W. Mackay.
Water Pollution Control, Vol 79, No 4, p 515-518, November, 1980. 1 Fig, 9 Ref.

Descriptors: *Hong Kong, *Municipal wastes, *Water pollution sources, Sea water, Sewage disposal, Sewage effluents, Industrial waste, Water pollution effects, Water pollution control, Planning.

The status of Hong Kong's waste discharges into Victoria Harbour, efforts at marine pollution control, effects on the aquatic environment, and future plans for pollution control are described. Total BOD wastes discharged into Hong Kong waters are about 140,000 tons per year. Domestic sewage generated by the 5 million inhabitants accounts for 65% of this total; agricultural wastes from 450,000 pigs and 5 million chickens, 15%; industrial effluents, 20%. About 750 tons per year of metals are discharged into the sea. Other problems are floating rubbish, oil pollution, and silt. About 90% of the population is served by the public sewer system. Thirty-six sewage treatment plants, including 17 secondary treatment plants, are in planning or construction. Seawater monitoring is conducted to provide data for planning. Some problems exist in the aquatic environment. In certain areas dissolved oxygen is low, nutrients and many metals are unacceptably high. Pathogens are monitored at the 37 regulated bathing beaches. Results are variable, but most record values less than 1,000 coliforms per 100 ml. Although marine pollution is not yet catastrophic, expansion of population, industry, and fish culture is expected to increase the pollution load by 50% within the next decade. An Environmental Protection Advisory Committee has been established to represent industrial and environmental groups in order to draft legislation and establish objectives for pollution control which will balance the interests of all parties. (Cassar-FRC)
W81-01349

EROSION BY CIRCULAR WALL JETS IN CROSS FLOW,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4D.
W81-01350

EFFECT OF NITRIFICATION ON MOVEMENT OF TRACE METALS IN SOIL COLUMNS,
California Univ., Davis. Dept. of Land, Air, and Water Resources.
F-H. Chang, and F. E. Broadbent.
Journal of Environmental Quality, Vol 9, No 4, p 587-592, October/December, 1980. 5 Fig, 7 Tab, 14 Ref.

Descriptors: *Nitrification, Metals, Movement, Denitrification, *Leaching, *Path of pollutants, Sewage sludge, Leachate, Soil chemical properties, Ammonia, Nitrogen compounds, *Soil tests, Hydrogen ion concentration, Sludge treatment, Nitrogen, Neutralization, *Heavy metals, Trace elements.

Sludge-treated and untreated samples of Omni silty clay and Delhi loamy sand were tested in soil column experiments to evaluate the effect of nitrification generated protons on the mobility of trace metals. Columns were leached two or three times per week with solutions of calcium chloride, ammonium chloride or potassium chloride, and the effluents after each leaching were analyzed for pH, inorganic N, percent 15N, and the metals Cd, Cr, Cu, Mn, Pb and Zn. After several months the columns were sectioned and the vertical distributions of hydrochloric acid-extractable metals were determined. All metals except Zn were present in effluents at average concentrations below 1 ppm. Ammonium chloride and potassium chloride leachings of Delhi loamy sand yielded effluents with Zn levels slightly above 1 ppm. Movement of Mn, Zn, Cu and Cd in untreated Delhi soil was influenced by nitrification. Sludge amended soil showed a stabilizing effect on Cd and Zn movement which was attributed to the formation of organo-metal complexes. Much of the input labeled NH4-N was denitrified, as indicated by N recoveries of 14-20% in the Omni soil and 40-78% in the Delhi soil. The generation of protons during nitrification was partially offset by neutralization during denitrification. It was concluded that metal mobility was affected very little by nitrification. (Geiger-FRC)
W81-01365

5F. Water Treatment and Quality Alteration

TREATMENT AND DISPOSAL OF SUGARBEET PROCESSING WASTE WATER BY IRRIGATION,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 3C.
W81-01220

CHLORINE RESISTANCE OF POLIOVIRUS ISOLANTS RECOVERED FROM DRINKING WATER,
Carborundum Co., Niagara Falls, NY. Electro Minerals Div.
P. T. B. Shaffer, T. G. Metcalf, and O. J. Sproul.
Applied and Environmental Microbiology, Vol 40, No 6, p 1115-1121, December, 1980. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Viruses, *Chlorination, *Water purification, Potable water, Water treatment, Public health, Standards, Resistance, Poliovirus.

Recent laboratory studies found that poliovirus 1, strain LSc, exhibited progressively greater resistance to inactivation by chlorine after exposure to sublethal doses of chlorine. This study tested poliovirus 1 isolates recovered from finished drinking water produced by a modern, well-operated water treatment plant, to see if they exhibited a similar increase in resistance to chlorine. The tested water contained free chlorine residuals in excess of 1 mg/liter. The chlorine inactivation of purified high-titer preparations of two such isolates was compared with the inactivation behavior of two stock strains of poliovirus 1, LSc and Mahoney. The surviving fraction of isolates was two orders of magnitude greater than that of the LSc and Mahoney strains. These studies suggest that a re-evaluation of the effectiveness of present disinfection practices as well as of the proposed chlorine-turbidity standard for drinking water may be necessary. Laboratory studies with stock virus strains may not always indicate what is actually going on in treated water. (Small-FRC)
W81-01248

LARGE-SCALE OZONE-DE FILTRATION: AN INDUSTRY FIRST,
Hazen and Sawyer, New York.
E. A. Bryant, and D. Brailey.
Journal of the American Water Works Association, Vol 72, No 11, Part 1, p 604-611, November, 1980. 4 Fig, 4 Tab, 3 Ref.

Descriptors: *Ozone, *Filtration, *Diatomaceous earth, Water purification, *Water treatment, *New York City, Croton system, Water quality, Potable water, Separation techniques, Costs, Environmental effects, Aesthetics, Alternate planning.

New York City chose the ozone-diatomaceous earth water treatment for improving water quality in its Croton system after comparisons with the high-rate conventional treatment and direct filtration with granular media. Considerations were effectiveness of treatments in meeting present and future standards, environmental impact, and costs. The ozonation-diatomaceous earth process produces water meeting all state standards, minimizes formation of chlorinated hydrocarbons, requires fewer but more highly skilled operators, deactivates bacteria and viruses prior to filtration, adjusts to rapid changes in quality of raw water, and needs less backwash water. The major reasons for the selection of the ozone-diatomaceous earth process are 30% less capital costs, compatibility with the environment, and adaptability to expansion to comply with future regulations. Disadvantages of the process are a lack of long-term experience on large scale units and the need for increased maintenance by a skilled staff. (Cassar-FRC)
W81-01288

CHLOROFORM PRODUCTION FROM THE CHLORINATION OF AQUATIC HUMIC MATERIAL: THE EFFECT OF MOLECULAR WEIGHT, ENVIRONMENT AND SEASON,
Canada Centre for Inland Waters, Burlington (Ontario).
B. G. Oliver, and S. A. Visser.
Water Research, Vol 14, No 8, p 1137-1141, August, 1980. 4 Fig, 3 Tab, 20 Ref.

Descriptors: *Water treatment, *Chlorination, *Humic acids, *Fulvic acids, Seasonal, Chloroform, Trihalomethanes, Rivers, Lakes, Organic compounds, Molecular structure.

Chloroform production from the chlorination of aquatic humic and fulvic acids that had been fractionated into eight molecular weight segments by ultrafiltration is discussed. Chloroform concentration per unit weight of humic material peaked at a molecular weight between 20,000-30,000 for the fulvic acids, and decreased with increasing molecular weight above 20,000-30,000 for the humic acids. Chlorination of samples from various aqueous environments (lake, river, stream, swamp, microbial) produced only minor fluctuations in chloroform concentrations. Chlorination of samples obtained from a single environment at different seasons of the year also produced similar chloroform concentrations. The authors conclude from their

sampling that the major chloroform precursors in aquatic humic material were the low molecular weight fraction (less than 30,000) of fulvic acids. The molecular weight and high surface activity of these fractions will make them difficult to remove by standard water treatment processes. (McKeon-FRC)
W81-01337

ST. LOUIS COUNTY STANDARDIZES PIPE AND PROCEDURES FOR RELIABILITY.
For primary bibliographic entry see Field 8G.
W81-01343

PROCEEDINGS -- SECOND SYMPOSIUM ON UTILITIES DELIVERY IN NORTHERN REGIONS.
Department of the Environment, Ottawa (Ontario).
Symposium held March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980. 550 p. Ottawa.

Descriptors: *Canada, *Conferences, *Public utilities, *Water delivery, *Cold regions, Water distribution(Applied), Waste disposal, Permafrost, Snow, Environmental sanitation, Sanitary engineering, Utilities, SCLAIRCOR, Building codes, Conference structures, Computer models, Pipelines.

The approaches, techniques, and materials suitable for northern utilities delivery systems were discussed in 30 technical presentations made at the conference. The papers cover eight topic areas: utility programs, energy considerations, technology applications, fire protection in the north, operation and maintenance, heat tracing and thawing, computer applications, and case studies. Factors that have contributed to the rapid development and improvement of northern systems include an improved understanding of thermal conditions through research, improved construction materials, emphasis on design and construction control, and better technology sharing and transfer. System reliability has been improved due to the efforts of those in charge of design, construction, and evaluation. (See W81-01382 thru W81-01411) (Seigler-IPA)
W81-01381

PROGRAMMING, DESIGN AND CONSTRUCTION OF UTILITIES IN GREENLAND,
Greenland Technical Organization, Copenhagen (Denmark).
G. P. Rosendahl.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 19-43. 19 Fig.

Descriptors: *Greenland, *Utilities, *Cold regions, *Sanitary engineering, Water supply, Water delivery, Sewage, Sewerage, Solid wastes, Ultimate disposal, Fire protection, Freezing, Public health, Surface waters.

The Greenland Technical Organization, established in the 1950's by the Danish Government, is responsible for all fields of technical development work in Greenland including water supplies, sewerage, refuse disposal, and fire protection. Greenland's water supply is based solely on surface water, and due to the varying topography, water supplies for most towns involve blast ditches, tunnels, gravity lines, and pump lines. Raw water lines are generally ductile cast iron pipes with electric heating cables. Water distribution is very expensive and most single-family housing areas are supplied by tank trucks, tank houses, or draw houses. Sewer lines are also very expensive and are intended for sewage only. All Greenland towns are situated on the sea so that sewage can be dumped directly without health or aesthetic drawbacks. Solid wastes removal and disposal is provided mainly by having established well-arranged hygienic conditions around disposal facilities including provisions for burning plastic/paper bags or cleaning buckets. Greenland's well organized fire protection system includes fire brigades, fire stations, an alarm system, water supplies, and instruction and training. (See also W81-01381) (Seigler-IPA)
W81-01383

A WATER SUPPLY SYSTEM FOR THE WORLD'S MOST NORTHERN PERMANENT COMMUNITY,
Department of National Defence, Westwin (Manitoba).
T. M. Y. Chong, and K. T. Mattes.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 367-393. 10 Fig, 1 Tab.

Descriptors: *Canada, *Cold regions, *Water distribution(Applied), *Water delivery, Plastic pipes, Freezing, Heat tracing, Insulation, Water treatment, Chlorination, *Pipelines, Water supply, Water conveyance, Water works, SCLAIRCOR.

The Canadian Forces Station Alert, located on the northern-tip of Ellesmere Island in the Northwest Territories, is installing a new water supply system that uses heat traced insulated pipe and sound engineering principles to virtually eliminate the possibility of freeze-ups. Alert's location 830 km from the North Pole makes it the world's most northerly permanent community. Design consideration for the new water supply system included reliability of service, fire flow and storage, method of construction, ease of operation and maintenance, early warning of problems, and energy conservation. Water is continuously pumped from the interior of heat traced insulated intakes by submersible pumps in Dumbell Lake. From the pumphouse the water enters a supply line made of heat traced insulated polyethylene pipe. At the water treatment plant the water is filtered, chlorinated, heated, and stored for pumping into the double loop distribution system. Due to costs, climate extremes, and a manpower shortage, the project has been divided into phases and, as of 1978, the new water supply line, treatment plant, and double loop distribution line were completed. Only one problem has occurred since the new water supply components were put into operation showing that severe climate conditions are no longer valid excuses for an inadequate water supply system. (See also W81-01381) (Seigler-IPA)
W81-01404

WATERWORKS SYSTEMS, YELLOWKNIFE, NORTHWEST TERRITORIES,
Reid, Crowther and Partners Ltd., Edmonton (Alberta).
J. R. Prentice, and G. A. Srouji.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 409-425. 1 Fig.

Descriptors: *Yellowknife(NWT), *Canada, *Water works, *Cold regions, *Water distribution(Applied), Freezing, Pipelines, Pumping, Pipes, Insulation, Heat tracing, Water supply, Water delivery, Water temperature, Pumping plants.

The City of Yellowknife, the most northerly major city in the western world, is taking steps to add to, and to modify its water system to meet the City's water demands up to the year 2001. The water system takes water from the Yellowknife River and pumps it through a submarine pipeline. A series of four pumphouses then pump the water to various areas such as the Giant and Con Mines, the central business district, the school, Forrest Park subdivision, the Mattonabee and Hospital districts, the Yellowknife Correctional Center, the mobile home park, and Frame Lake South. At least one more pumphouse/reservoir system will have to be installed for the Niven Lake subdivision. Each of the pumphouse units has its own distribution system with the key elements of the overall system being pumphouses 3, 4, and 1. As much of the system as possible is underground and methods taken to prevent freezing include heating the water prior to pumping, heat traced cables, and insulated pipes. Each subsystem has its own separate control and monitoring system. As the waterworks system continues to expand, existing relay systems in the 'old' pumphouses will be converted to programmable controller systems. An advantage of Yellowknife's planning was the discovery that heating requirements per liter of water in a given section of pipe have decreased over the years due to a build-up of lost heat. (See also W81-01381) (Seigler-IPA)
W81-01406

NEW APPROACHES TO WATER AND SEWER SERVICES IN PERMAFROST AREA -- NORMAN WELLS, N.W.T.,
M. M. Dillon Ltd., Edmonton(Alberta).
W. W. Irwin.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 507-542. 15 Fig, 1 Tab.

Descriptors: *Canada, *Cold regions, *Public utilities, *Water distribution(Applied), *Sewage treatment, Plastic pipes, Maceration, Sewers, Utilidors, Waste disposal, Conveyance structures, Sanitary engineering, Water delivery, Freezing.

From 1976 through 1978 the community of Norman Wells, located about 140 km south of the Arctic Circle, carried out a program of replacement and expansion of its water distribution and sewage collection services. Prior to improvements the community was serviced by a deteriorating utilidor system that was feeling the pressure for growth due to the then imminent Mackenzie Valley Pipeline. New system concepts were designed after geotechnical contraints were identified and basic material selections were completed. High density polyethylene and steel pipes were selected for buried services and ductile iron and steel for above ground services. Existing portions of the utilidor system were incorporated wherever practical. Essential elements of the water system are a single loop circulating distribution main, pretempering facilities and pumps houses in the existing booster pumping station, and a large heated storage reservoir. The sewage system has well-graded sewer lines and improved disposal facilities. All sewage is piped to a common outfall where maceration and submerged disposal facilities release the sewage well away from the shore. Performance of the system has been in general above expectations. Total cost for the water and sewage systems when completed will be in the order of $3.5 million. (See also W81-01381) (Seigler-IPA)
W81-01411

5G. Water Quality Control

STORMWATER MANAGEMENT TECHNOLOGY SYSTEMS DEMONSTRATION IN THE CITY OF ST. THOMAS.
MacLaren (James F.) Ltd., Toronto (Ontario).
Environment Canada, Canada Mortgage and Housing Corporation, Ottawa, Sewage Collection and Treatment (SCAT) Report 3, November, 1980. 212 p, 66 Fig, 26 Tab, 14 Ref, 7 Append.

Descriptors: *Storm runoff, *Water management(Applied), *Cost analysis, Technology, Urban drainage, *Water pollution soources, Computer models, *Urban runoff, Water pollution, Runoff forecasting, Canada, Storms, Storm water, Surface runoff, *Model studies, Simulation analysis, Mathematical models, Econometrics, Alternative costs, Planning, Biochemical oxygen demand, *St. Thomas(Ontario).

Advanced stormwater management techniques were used to determine cost-effective solutions to stormwater flooding and pollution problems in the City of St. Thomas. The development, use, and advantages of these techniques were reviewed, and a generalized methodology for their application to stormwater problems in other municipalities has been provided. Computer analysis and modeling techniques were used to evaluate solutions to three aspects of the drainage problem in St. Thomas: flood relief, and dry weather and wet weather pollution abatement. Dry weather problems were caused mainly by very low flow rates in the re-

ceiving water; combined sewer overflows and treatment plant by-passes were the major sources of pollution during wet weather. A priority-ranked total management program was designed for the city, composed of three cost-effective measures: (1) improved efficiency and increased frequency of street sweeping to reduce wet weather BOD loading to Kettle Creek; (2) effluent pipeline construction to Lake Erie to eliminate all dry weather effluent loadings to Kettle Creek; and (3) completion of sewer separation in combined sewer areas to eliminate basement flooding and combined sewer overflows. Estimated BOD reductions were 25, 44, and 25% for these three measures, respectively. (Zielinski-IPA)
W81-01211

WATER BANK PROGRAM, 1972 THROUGH SEPTEMBER 30, 1979.
Agricultural Stabilization and Conservation Service, Washington, DC. Management Services Div. Report, February, 1980. 10 p, 4 Tab.

Descriptors: *Wildlife habitats, *Habitat improvement, *Wetlands, *Water control, Migratory birds, Waterfowl, North Dakota, South Dakota, Minnesota, Wildlife conservation, Conservation, Potholes, Erosion, *Water Bank Program.

Under the Water Bank Program, the Secretary of Agriculture is authorized to enter into 10-year agreements with landowners and operators in improtant migratory waterfowl nesting and breeding areas to preserve, restore and improve the nation's wetlands. The area placed under the program is designed to preserve and improve habitat for migratory waterfowl and other wildlife resources, to reduce runoff and soil and wind erosion, and to contribute to water control. The program is being concentrated in the pothole wetland areas of the Central and Mississippi flyways with a limited number of counties in other wetland areas of the country. From 1972 through 30 September 1979, 5,227 agreements have been carried out under the program involving a total of 590,367 acres. Of this, 162,296 acres are wetlands and 428,071 acres are adjacent areas. North Dakota, South Dakota and Minnesota had the greatest number of agreements. Payments under the program have amounted to $7,094,784. (Moore-SRC)
W81-01229

TEMPORARY PIPELINE AVERTS WATER QUALITY EMERGENCY.
Public Works, Vol 111, No 12, p 40-41, December, 1980. 1 Fig.

Descriptors: *Pipelines, *Farm wastes, Water pollution, Reservoirs, Water quality, Public health, Pumping, Watersheds, Water pollution sources, *Water pollution control, Hogs.

When the impounding reservoir of the Farnham, Quebec water system became polluted by a hog farm in the watershed, the Farnham treatment plant had to take rapid emergency measures to protect the public from developing skin rashes and other health problems associated with use of the contaminated water supply. Under the approval of local and provincial officials, plant authorities contracted with the Williamstown Irrigation Corporation to lay a temporary pipeline to feed the treatment facility with water supplies upstream of the reservoir and the source of pollution. The pipeline took only days to lay, and with the aid of pumps, plant capacity was brought up to the expected load of 3.6 mgd. The Tico brand pipe which was used for the emergency situation in Farnham is stocked by the Williamstown company in 30 foot lengths to supply up to 2 miles of pipeline in unexpected situations. The company has the ability to fabricate more pipeline in a short period of time when needed. The pipe was laid along the path of a railroad bed and spanned a transmission route of about 2.5 miles. (Geiger-FRC)
W81-01284

INDEX TO EVALUATE LAKE RESTORATION,
Tetra Tech, Inc., Lafayette, CA.
D. B. Porcella, S. A. Peterson, and D. P. Larsen.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE6, p 1151-1169, December, 1980.

Descriptors: *Lakes, *Water quality control, *Mathematical studies, Water quality, Model studies, Water pollution control, Limnology, Federal Water Pollution Control Act, Phosphorus, Dissolved oxygen, Nitrogen, Chlorophyll, Turbidity, Eutrophication, Aquatic plants, Aquatic algae, *Lake restoration, Evaluation.

In an ongoing project to devise methods of restoring polluted lakes and preventing the contamination of clean lakes, target variables of water quality were analyzed independently and in combinations to arrive at a Lake Evaluation Index (LEI) to facilitate comparisons of water quality of various bodies of water. The LEI was used to express the overall change in water quality that might occur as a result of restoration process. It was hoped that the LEI would allow more precise evaluations of the efficiencies of various treatment procedures on a wide variety of lakes. Some of the limnological parameters included in the LEI are total phosphorus, total nitrogen, chlorophyll, Secchi depth, dissolved oxygen, and macrophyte coverage. Lake managers using the new index will be able to monitor shifts in the LEI numbers to readily assess changes in water quality. When the LEI system was applied to two restored lakes, results showed that the index was responsive to restoration efforts that actually produced changes in lake quality. When the water improvement effects of some restoration procedures were delayed, the LEI also reflected this time lag in response. (Geiger-FRC)
W81-01296

METHOD FOR REMOVING OIL FILM FROM WATER SURFACE,
T. V. Abaeva, N. M. Antonova, J. K. Lukmanov, O. S. Mochalova, and I. A. Nemirovskaya.
U.S. Patent No 4,197,197, 4 p, 5 Ref; Official Gazette of the United States Patent Office, Vol 993, No 2, p 621, April 8, 1980.

Descriptors: *Patents, *Water quality control, *Water pollution treatment, *Oil pollution, Dispersants, Surfactants, Biodegradation, Chemical reactions, Petroleum.

The invention relates to a dispersant for removing petroleum and petroleum products from the surface of water basins. The dispersant comprises an aqueous solution of a surfactant, viz. a mixture of salts of phosphoric acid esters and hydroxyethylated higher aliphatic alcohols. The dispersant is a non-toxic biologically degradable compound which enables its use for the removal of petroleum and petroleum products not only from the sea surface but also from the surface of shallow and small-size closed water basins. (Sinha-OEIS)
W81-01421

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

METHODS FOR DERIVING OPTIMAL OPERATING RULES FOR MULTIPLE RESERVOIR SYSTEMS,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
L. E. Johnson, D. P. Loucks, and J. R. Stedinger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156671, Price codes: A06 in paper copy, A01 in microfiche. Project Completion Report, December, 1980. 97 p, 37 Fig, 2 Tab, 44 Ref, 2 Append. OWRT-A-088-NY(1), 14-34-0001-0134.

Descriptors: *Reservoir operation, *Optimization, *Planning, Simulation analyses, Systems analysis, Competing uses, Linear programming, *Model studies, *Multiple-purpose reservoirs.

Using both optimzation and simulation models in an interactive manner through the use of computer graphics, an approach is discussed for defining multiple reservoir operating policies. These policies are specified in a form familiar to reservoir operators, namely zones of reservoir storage that may vary in magnitude throughout the year and which denote water to be allocated to specific uses downstream. The optimization models used to define these zones also provide estimates of the reliabilities of meeting various downstream demands from each of the storage zones. Flood storage is also considered, and all zones are simulated to further improve and evaluate the effectiveness of the multiple reservoir operating policies. Flood storage is also considered. The operation of multi-reservoir operating policies based on flood and conservation storage zones are simulated to further improve and evaluate the effectiveness of the multiple reservoir operating policies.
W81-01204

QUENCHING THE THIRST FOR POTABLE WATER IN ARID SAUDI ARABIA,
American Water Works Association Research Foundation, Denver, CO.
J. F. Manwaring, R. G. Lee, and J. W. Hoffbuhr.
Journal of the American Water Works Association, Vol 72, No 12, p 656-665, December, 1980. 8 Fig, 1 Tab.

Descriptors: *Water supply, *Saudi Arabia, Water shortage, Reverse osmosis, Water treatment, Water resources, Water quality control, Potable water, Water resources development, Arid lands.

The drinking water conditions in terms of quality and facilities in rural areas of Saudi Arabia were investigated along with the existing operation and maintenance programs used by the water systems and the regulatory control exercised over these systems. The poor water conditions prevalent in the rural municipalities result from environmental conditions limiting the availability of high quality source water, the explosive growth that is placing new and heavy demands on municipal water supplies, the lack of treatment facilities, and the absence of proper operating and maintenance procedures. On the other hand, the country has an extremely advanced reverse osmosis plant near the capital, emphasizing the vast contrasts in this country, which present additional problems. The lack of significant rainfall places the demand far in excess of the supply. Existing rural water supply facilities, consisting of wells, treatment plants and distribution systems, and storage facilities must advance as the country becomes more industrialized. Improvements are needed in the areas of water system information, training of personnel, monitoring, preventive maintenance, inventory, and record keeping. A practical and cost-effective approach to rectify the problems is presented. (Baker-FRC)
W81-01287

WHICH PLANT EXPANSION IS THE MOST URGENT ONE IN A RIVER SYSTEM AND HOW TO DEVELOP A PRIORITY LIST,
Ruhrverband, Essen (Germany, F.R.).
K. R. Imhoff.
Progress in Water Technology, Vol 12, No 3, p 119-122, 1980. 1 Tab, 4 Ref.

Descriptors: *Equations, *Water quality, *Feasibility, *Project planning, Effluents, Biochemical oxygen demand, Rivers, Chemical oxygen demand, Priorities, *Waste water treatment, Europe.

Three mathematical expressions are formulated and then combined to evaluate the quality of receiving water, the waste water discharge, and the feasibility of plant expansion. Effluent quality equals the average COD or BOD concentration of the effluent in dry weather in mg/liter divided by the goal or standard COD or BOD in mg/liter. Receiving water quality is calculated below the proposed discharge point at low flow and is equal to the COD or BOD at low flow in mg/liter divided by the goal or standard COD, also in mg/liter. Feasibility is calculated by relating additional load reduction to additional cost. The related additional load reduction of the specific project being considered is divided by the corresponding load to

cost ratio of a reference plant. The priority of a project can be defined as the product of the feasibility, effluent quality, and receiving water quality. (Small-FRC)
W81-01320

ANALYSIS OF PREVENTIVE SEWER MAINTENANCE PROGRAMS,
J. E. Liebeskind.
Public Works, Vol 111, No 12, p 45-48, 76, 77, December, 1980. 2 Tab.

Descriptors: *Sewers, *Repairing, *Water resources planning, Economic efficiency, Management, Coordination, Maintenance, Administration, Estimated costs, Forecasting, Budgeting, Census.

Elements of successful preventive sewer maintenance programs are identified, based on a study of six exemplary programs. Preventive maintenance programs insure the integrity of the collection system as planned, designed and constructed, and produce long-term cost savings. Effective management is the cornerstone of sewer maintenance. This includes collection of accurate records, analysis of trends, accounting, and detailed sewer mapping. Services should be provided by contract when cost-effective or when special skills are required. Surveillance, inspection, and monitoring activities provide information necessary to develop and plan operation and maintenance programs. Techniques include lamping, photography, weirs, metering, smoke testing, dye testing, and surface indicators such as depressions. The study indicates that sewer districts of all sizes can incorporate elements cited here in preventive maintenance programs. (Titus-FRC)
W81-01322

WATER QUALITY AND HUMAN ACTIVITIES: A MONITORING AND MODELING EFFORT IN FINLAND,
National Water Board of Finland, Helsinki.
For primary bibliographic entry see Field 6B.
W81-01326

DEVELOPMENT OF IMPROVED WATER MANAGEMENT PRACTICES IN PAKISTAN,
Colorado State Univ., Fort Collins. Engineering Research Center.
G. V. Skogerboe, W. D. Kemper, and J. O. Reuss.
Water Supply and Management, Vol 4, No 5/6, p 299-312, 1980. 1 Fig, 26 Ref.

Descriptors: *Pakistan, *Irrigation canals, *Water management, Agricultural engineering, Water conveyance, Organizations, Training, Farm management, *Water resources development.

Since 1976 an On Farm Water Management Pilot Project has been underway in Pakistan. This work involves imprpovement of 1,500 of the country's 80,000 watercourses to reduce water losses through cleaning and lining channels, precision land leveling, and improvement of agronomic and irrigation practices. Institutional objectives of this project comprise development of a core of water management advisors, engineers, and agriculturists; a permanent research program; farmer education; a network of water users' associations, and a private enterprise for manufacturing and marketing water management equipment. The University of Agriculture at Faisalabad agreed to provide training for advisory personnel in a 4 and 1/2 month course which is 75% field work and 25% classroom work. The project will continue with a detailed evaluation of a sampling of watercourses by field examination and personal interview. After 2 and 1/2 years of activity the target number of watercourses had not been investigated. However, the farmers were highly receptive to the field teams. Training programs are producing increasing numbers of field personnel. (Cassar-FRC)
W81-01328

INPUT-OUTPUT MODELING FOR FACILITY LEVEL WATER PLANNING,
Catania Univ. (Italy). Ist. di Idraulica Idrologia Gestione Acque.
B. M. Reitano, and D. W. Hendricks.
Water Supply and Management, Vol 4, No 5/6, p 379-396, 1980. 10 Fig, 2 Tab, 8 Ref.

Descriptors: *Input-output analysis, *Systems analysis, *Planning, Cache La Poudre River Basin(CO), Model studies, River basins, Colorado, *Water resources development.

An input-output water transaction table for the highly complex Cache La Poudre, Colorado, water system required 1 man-year for development. Using a matrix format, it has 123 components and shows 400 water transactions. The construction of an input-output model is described, using the Cache La Poudre system as an example. This model has 9 categories (entries, exits, reservoirs, ditches, industries, etc.) with a total of 109 components (specific waterways, treatment plants, etc.). The time factor is represented by both time increment and calendar position. Line diagrams are used to define connections between components. 109 mass balance diagrams and explanatory notes provide the data base. This time-saving model presents the water system in a form easily understood by persons unfamiliar with the system. (Cassar-FRC)
W81-01331

A SYSTEMS APPROACH TO THE STUDY OF INTERBASIN WATER TRANSFERS: THE PARTIAL DIVERSION OF THE USSR'S NORTHERN RIVERS FLOW INTO THE VOLGA,
Soyuzgiprovodkhoz, Moscow (USSR).
N. N. Moiseev, A. S. Berezner, F. I. Ereshko, and A. V. Lotov.
Water Supply and Management, Vol 4, No 5/6, p 323-337, 1980. 2 Fig, 6 Ref.

Descriptors: *Systems analysis, *River basin development, *Inter-basin transfer, Water transfer, *Russia, Optimum development plans, Caspian Sea, Azov Sea, Transportation, Fisheries, Volga River basin, Irrigation, Agriculture, Forecasting, Planning.

A systems analysis approach to solve the problems of supplying water to southeastern European Russia is discussed. The problem is to be solved by diverting some of the runoff from northern rivers to the Volga Basin. Objectives are described in a hierarchal system, that is, certain lower level objectives must be solved before answers to the higher levels may be found. First level problems concern overall social development (examples, increases in population's living standard). The second level relates to rational use of water resources (protection of environment). The third and fourth levels concern water supply activities (examples, pollution treatment, desalinization, rainfall stimulation). Several conclusions were reached by analysis of combinations of alternatives from various groups. The Ob River should not be diverted because costs would be too high. Cessation of new irrigation activities will not solve the problems of the Caspian Sea. Present irrigation growth rates should be continued into the future. New methods of irrigation (drop, mist, subsurface) should grow at a rate not greater than 2-3% because of high capital costs. Reduction of the level of the Caspian Sea is not desirable. Restoration of fisheries in the Azov Sea can be accomplished by a dam in the Straits of Kerch. Priority should be given to hydroelectric power generation at the Volga-Kama facilities. Water transportation depth should initially remain at the standard level and later be increased. Water transfers should include 35-40 cubic km of water per year from Lake Onega and adjoining rivers. Minimal disturbances would result if water were drawn from a reservoir to be built on the Onega River estuary. These alternatives will meet the water requirements of European USSR into the distant future. (Cassar-FRC)
W81-01335

STOCHASTIC GENERATION OF ANNUAL STREAMFLOWS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
R. Srikanthan, and T. A. McMahon.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY12, p 2011-2028, December, 1980. 5 Tab, 20 Ref.

Descriptors: *Mathematical models, *Streamflow, *Australia, Flow measurement, Annual, Reviews, Natural streams, Correlation analysis, Theoretical analysis, Variability, Streamflow forecasting, Monte Carlo method.

At present, several models exist for the generation of streamflow that are useful in planning water resources development. Some short memory models such as the Markov and ARIMA, which are autoregressive models, belong to the short memory group. Fractional Gaussian noise and broken line systems belong to the long memory models. These models and some variations on them were applied to a set of Australian streams, and an operational comparison was made. The ARIMA model was shown in a series of Monte Carlo simulations to be capable of producing data from which the lag one autocorrelation and Hurst coefficients could be estimated from the streamflow series. The ARMA model with a Box-Cox transformation, the ARMA-Markov model, and the white-Markov model did not successfully preserve the autocorrelation, while the other models examined preserved all the input parameters. Short memory models preserved the Hurst coefficient to a greater extent than the long memory models when the value of the coefficient was less than or equal to 0.65. None of the systems examined preserved the Joseph effect in the sequences generated, especially in the case of highly variable streams. (Geiger-FRC)
W81-01369

RURAL SCHOOLS PROTOTYPE ANALYSIS,
Construction Systems Management, Inc., Anchorage, AK.
T. W. Livingston, and N. Kjeistad.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 439-474. 9 Fig.

Descriptors: *Alaska, *Cold regions, *Schools(Education), *Facilities, Design criteria, Water supply, Design standards, Construction, Buildings, Specifications, Design data, Building codes, Environmental engineering, Secondary schools, Rural areas, Community development, Public utilities.

A resource guide was developed to aid designers, school district personnel, and State administrators in the planning and construction of the many Alaskan rural secondary schools to be built in the next few years. No overall, universally desirable design is possible as schools may range from 23 students with 2 teachers to 800 students with 30 teachers. The guide has three volumes, Volume I, Design Determinants and Options; Volume II, Methodology; and Volume III, Field Data. Alaska bush schools are not simple buildings with classrooms as in normal urban areas, rather they must be a self-sufficient community facility that operates and maintains its own utility system, in addition to providing an education program. Design determinants must consider building program determinants, environmental determinants, and site utilities determinants. Four enrollment sizes were used to provide rural schools prototype analysis. The guide provides checklists for identifying various design determinants. An example of the use of the guide is given using the design of a secondary school for the fictitious village of Kuchpu, Alaska. Facility sections and floorplans are used to illustrate school designs. (See also W81-01381) (Seigler-IPA)
W81-01408

WATER AND SEWER UTILITIES FOR BARROW, ALASKA,
CH2M/Hill, Anchorage, AK.
L. D. Leman.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 484-506. 7 Fig.

Group 6A—Techniques Of Planning

Descriptors: *Alaska, *Utilities, *Utilidors, *Cold regions, *Urbanization, Utiliducts, Planning, Water works, Water distribution(Applied), Community development, City planning, Sewers, Underground structures, Conveyance structures, Electrical service, Television, Telephone lines.

A detailed analysis of the utility needs and constaints of Barrow, Alaska, has lead to the recommendation of a combination of above- and below-ground utilidors to best meet the community's requirements. In the central core area, where traffic and existing structures make convenience and aesthetics important, below-ground utilidors are recommended. In areas such as Browerville, where cost is the controlling factor, above-ground portions are recommended. The study was based on the premise that a coordinated utility system can best be provided through construction of large insulated utility conduits (utilidors) to carry primary distribution and collection pipes and wire throughout the community. Smaller conduits (utiliducts) will connect the service to houses and other buildings. The utilidors will also have space for telephone, television, and electrical service lines in addition to sewer and water lines. Utilidors should be constructed of steel, ductile iron, or wood staves. Pipes should be copper, high molecular weight polyethylene, or galvanized iron. A capital cost of $52 million is estimated for the system with a monthly operating and maintenance cost per unit of $168. Final design is still pending and because the estimated $52 million project cost is beyond normal funding levels for such projects, special dispensations from several agencies may be required. (See also W81-01381) (Seigler-IPA)
W81-01410

6B. Evaluation Process

AN EMPIRICAL APPLICATION OF A MODEL FOR ESTIMATING THE RECREATION VALUE OF INSTREAM FLOW,
Colorado State Univ., Fort Collins. Dept. of Economics.
R. G. Walsh, R. K. Ericson, D. J. Arosteguy, and M. P. Hansen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156614, Price codes: A05 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report No 101, October, 1980. 66 p, 7 Fig, 11 Tab, 63 Ref. OWRT-A-036-COLO(2), 14-34-0001-8006.

Descriptors: *Model studies, Estimating, *Recreation demand, *Use rates, *Water sports, Fishing, *Cost-benefit analysis, Experimental models, Research and development, Synthesis, Testing, Reasonable use, Water utilization, Water allocation(Policy), Benefits, Public benefits, Fringe benefits, Riverflow, Streams, Public access, *Rocky Mountains(CO), Colorado.

Public benefits from cold water river fishing, kayaking and rafting on the West Slope of the Colorado Rocky Mountains were assessed during the summer of 1978 using a representative sample of 206 persons interviewed at nine river sites. Willingness to pay was found to be contingent on changes in congestion and water level. Recreation benefit functions were related to several important variables, including instream flow, crowding, characteristics of participants, and management costs. Policy implications were discussed with emphasis on application of the information to water management decisions. The contingent valuation approach proved successful for valuing the public benefits for this study area. The technique appeared appropriate for valuation of a wide variety of non-market goods, including the effects of congestion and instream flow. Expanding fishing opportunities would provide benefits to individuals having access to western rivers due to the result of less congestion at substitute sites. Providing optimum access to 15% more miles of river would increase western fishing benefits by an average of $1.25 per user-day. Marginal analysis found maximum total benefits for kayaking/rafting during spring/early summer; but for boating/fishing, from late July through September. (Zielinski-IPA)
W81-01210

EFFECTS OF NATURAL GAS PRICE INCREASES ON TEXAS HIGH PLAINS IRRIGATION, 1976-2025,
Winrock International Livestock Research and Training Center, Morrilton, AR.
K. B. Young, and J. M. Coomer.
Department of Agriculture, Economics, Statistics, and Cooperatives Service, Agricultural Economic Report No 448, February, 1980. 35 p, 3 Fig, 14 Tab, 24 Ref, 1 Append.

Descriptors: *Natural gas, *Irrigation, *Grains(Crops), *Cotton, *Prices, *Texas, Farm prices, Economics, Sorghum, Wheat, Dry farming, Projections, Pumping, Operating costs, High plains(TX).

Irrigation pumping costs, irrigated acreage, cropping patterns, and annual net farm income were projected for the period 1976-2025 in a 32-county region of the Texas High Plains. Alternative price scenarios for major grain crops and natural gas were used in the projections. Grain sorghum and cotton output projections, based on a constant gas price and intermediate-level grain prices, showed a decline of 61 and 33%, respectively. Wheat output from increased dryland production rose 23%. Similarly, the rising natural gas price and intermediate-level commodity prices produced a wheat output increase of 44%, a grain sorghum decrease of 70%, and a cotton decrease of 33%. Irrigation-pumpage, when a constant natural gas price was used, declined from 5 million acre-feet in 1976 to less than 1.2 million in 2025, and estimated annual net crop income declined from $277 million to $185.5 million. Irrigation of major crops when an increasing natural gas price was used was projected to terminate in 1995, and annual net crop income to decline from $277 million to $164 million. Use of high-level grain prices as a base resulted in more intensive irrigation development for 1976 to 1990, but irrigation termination was still projected to occur at approximately the same date, 1995. The price of natural gas was the primary factor affecting the economic life of irrigation in this analysis. (Author's abstract)
W81-01222

AN EVALUATION OF 'A PROCEDURE FOR DESCRIBING FISH AND WILDLIFE IN PENNSYLVANIA',
Fish and Wildlife Service, Kearneysville, WV. Eastern Energy and Land Use Team.
Task Force Report FWS/OBS-79/19-A, September, 1980. 18 p, 2 Tab.

Descriptors: *Methodology, Wildlife, *Data collections, Standards, *Ecological Distributions, *Pennsylvania, Fish, Costs, *Wildlife habitats, Distribution, Wildlife management, Information exchange, Legal aspects.

A proposed methodology for summarizing fish and wildlife species distribution and habitat data was evaluated by EELUT and outside reviewers to assess its scientific and technical acceptability and usefulness. The procedure was found to be within legal constraints and cost-effective. Ninety-one percent of all reviewers thought the procedure was an accurate, comprehensive, and useful standard method for describing fish and wildlife species; 91% also thought an information system would be useful for regulatory programs, preparing and reviewing impact assessments and statements, planning and coordination activities, land and water management programs, resource inventory and assessment, land acquisition, research, and information transfer. Data compiled using the procedure in Pennsylvania was examined and found to be 95% consistent with the coding instructions and 88% accurate, when compared to the reference sources. The species list for the Pennsylvania data base was found to be more comprehensive than other sources of species lists and compared well with other specialized lists. (Moore-SRC)
W81-01231

ECONOMICAL CONSIDERATIONS ON LOCAL OR CENTRALIZED WASTE WATER TREATMENT SYSTEMS,
Ruhrverband, Essen (Germany, F.R.).
G. W. Annen.
Progress in Water Technology, Vol 12, No 3, p 123-217, 1980. 4 Fig, 1 Tab.

Descriptors: *Construction costs, *Project planning, *Operating costs, Economic efficiency, *Waste water treatment, Cost analysis, Treatment facilities, Europe, Federal Republic of Germany.

Because of the tendency of operating costs to continue to increase a centralized waste water treatment facility may have advantages over decentralized systems. The construction costs of a centralized system are higher, but when the operating costs are considered, centralized sewage treatment is the most economical solution. Data on over 100 biological treatment plants of the Ruhrverband are discussed, and the exponential regression of both construction cost and operating cost with increasing population is presented. The discount method is used to give one figure for both construction and operating costs. The causes of increasing operating costs are not discussed fully, but inflation is mentioned as a factor. (Small-FRC)
W81-01319

WATER QUALITY AND HUMAN ACTIVITIES: A MONITORING AND MODELING EFFORT IN FINLAND,
National Water Board of Finland, Helsinki.
P. Heinonen, J. Eloranta, K. Kinnunen, T. Kohonen, and K. Noukka.
Water Supply and Management, Vol 4, No 5/6, p 339-369, 1980. 11 Fig, 7 Tab, 50 Ref.

Descriptors: *Water quality, *Cost-benefit analysis, *Model studies, *Finland, Water pollution, Waste water treatment, Industrial wastes, Effluents, Planning, Lake Paijanne(Finland), World Bank, KVT project, Pollutant identification, Financing, Participating funds, Cost allocation.

The Republic of Finland initiated a research program on water pollution as a stipulation for a World Bank loan to be applied toward an industrial water protection program scheduled for 1975-1977. This program, known as the KVT project, had several concerns. Manual and automatic monitoring systems measured pollution in various streams and rivers. Literature studies of several aquatic ecological models were applied to Lake Paijanne. Cost-benefit analysis methods were developed to estimate economic efficiency of water protection programs. An effluent charge system was devised to create incentives for industries to minimize their pollution discharges. The World Bank can apply information gathered from these studies toward financing similar projects elsewhere in the world. (Cassar-FRC)
W81-01326

INDIGENOUS RESOURCES AND WATER SUPPLY MANAGEMENT,
International Labour Organization, Geneva (Switzerland). Employment and Development Dept.
For primary bibliographic entry see Field 4B.
W81-01329

A POST AUDIT EVALUATION OF METHODOLOGY FOR WILD AND SCENIC RIVER DEVELOPMENT AND MANAGEMENT, THE CLEARWATER RIVER, IDAHO: A CASE STUDY,
Idaho Univ., Moscow. Dept. of Agricultural Economics.
R. O. Brooks, and E. L. Michalson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157109, Price codes: A04 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, University of Idaho Completion Report, August, 1980. 53 p, 3 Fig, 11 Tab, 25 Ref, 2 Append. OWRT-C-7511(No 6233)(1), 14-34-0001-6233.

Descriptors: *Surveys, *Wild River Act, *Scenic easements, *Evaluation, *Water resources develop-

ment, Public benefits, *Surveys, Wild rivers, Scenery, Legislation, Water policy, Baseline studies, Legal aspects, Recreation, Running waters, Rivers, Easements, Public access, Natural resources, Zoning, Water resources, Benefits, Assessments, Idaho, Economic import, Agriculture, Forestry, Mining.

Statistical techniques were used to analyze the scenic easement program, as well as economic impacts on the value of agricultural, timber, and mining resources. By compiling data on these resources over time, it was possible to estimate the change in value caused by the 1968 Wild and Scenic Rivers Act. Data were collected by means of structured and unstructured interviews held with Forest Service personnel, county officials, and local industry owners and managers, and by use of structured questionnaires administered to private landowners within the river corridor. The results of the analysis showed that the classification of the Middle Fork of the Clearwater has not had any significant economic affect on any of the area's resources, except for the value of land encumbered with scenic easements. The restrictions imposed on the agricultural, timber, and mining resources have not and will not curtail their productive services or limit their growth. The least squares regression model used to estimate scenic easement payments indicated that appraisal techniques employed by the various appraisers were consistent and acceptable. (Zielinski-IPA)
W81-01379

A POST AUDIT EVALUATION OF METHODOLOGY FOR WILD AND SCENIC RIVER DEVELOPMENT AND MANAGEMENT, THE CLEARWATER RIVER, IDAHO: A CASE STUDY OF PUBLIC INVOLVEMENT PRACTICES,
Idaho Univ., Moscow. School of Communications.
J. K. VanLeuven.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157125, Price codes: A06 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, University of Idaho Completion Report, August, 1980. 91 p, 33 Tab, 20 Ref, 1 Append. OWRT-C-7511(No 6233)(2), 14-34-0001-6233.

Descriptors: *Wild River Act, *Scenic easements, *Evaluation, *Water resources development, *Public benefits, *Surveys, Wild rivers, Legislation, Scenery, Water policy, Recreation, Baseline studies, Rivers, Running waters, Easements, Legal aspects, Public access, Zoning, Natural resources, Water resources, Benefits, Assessments, Idaho.

The uniqueness of the Idaho Clearwater Wild River Program, the Nation's first wild river program, was delineated from a planning standpoint. Methodologies were designed to recognize the nature of this ten-year-old program and to suggest a validity procedure for measuring the human impacts of other established water resource programs. The program covers the Clearwater Middle Fork, including the Lochsa and Selway Rivers. Three principal methodologies were used: (1) an attitude survey of 280 affected landowners and public involvement participants, designed to show any discrepancies between orginal expectations and current assessment of the program; (2) a personal value analysis to indirectly assess how members of nine affected interest groups felt their personal values/ideals have been served by the program, to provide a validity measurement; and (3) application of the 1969 and 1970 public involvement/information programs to the public involvement objectives of the U.S. Forest Service's 1977 'Inform and Involve' draft handbook. The results of this study supported the initial program efforts and recommended that additional public involvement techniques be implemented. Three formats were suggested for a new ongoing program: (1) neighborhood workshops, (2) a wild river program newsletter, and (3) an educational program for tourists, school children, and others less aware of the program. (Zielinski-IPA)
W81-01380

APPROPRIATE TECHNOLOGIES FOR WATER SUPPLIES AND SANITATION IN NORTHERN COMMUNITIES,
International Development Research Center, Ottawa, (Ontario). Health Sciences Div.
M. G. McGarry, T. Jackson, W. Rybczynski, A. V. Whyte, and A. P. Zimmerman.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 121-135. 1 Fig.

Descriptors: *Canada, Indian reservations, *Sanitary engineering, *Cold regions, *Sewage disposal, Environmental sanitation, Public health, Enteric bacteria, Eutrophication, Water supply, Education, Epidemics, Human diseases, Potable water.

The Big Trout Lake Indian Reserve on Post Island, west of James Bay in Northern Ontario, is an example of community participation in the design of water and sanitation facilities in Indian communities in the north. Like most Indian communities in northern Canada, the 600 Cree-speaking indigenous people of the reserve are dependent on buckets in the summer and ice block collection in the winter as a water source. A team of professionals with international development experience in water supplies and sanitation was brought in and emphasis was placed on community participation. The team found that sewage from the community would have to be contained to stop eutrophication and fecal contamination of the lake, a major water source for the community. No native houses were found to have piped water and pit latrines were used for defecation. The team recommended a dynamic process of improvements as no single technology could be uniformly applied and afforded. Water supply alternatives include catchment by roof, hand pumps, street taps or standpipes, and truck delivery. Excreta disposal alternatives include improved or lined pit latrines, moldering toilets, and a truck collection system. Big Trout Lake illustrated that how choices are made is as important as what choices are made, and community education is of high priority. (See also W81-01381) (Seigler-IPA)
W81-01387

INTRODUCTION TO FIRE PROTECTION IN THE NORTH,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
G. W. Heinke.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 223-224.

Descriptors: *Fire protection, *Cold regions, *Northern regions, *Burning, Insurance, Protection, Risks, Cost analysis, Evaluation, Value engineering, Cost-benefit analysis.

To achieve an adequate level of fire protection and prevention in northern communities the real requirements must be examined, objectives for public and private systems must be stated, and a suitable system must be designed and maintained. Most northern communities are small and do not have the funding or management capabilities to own and operate an adequate fire system. Other factors making fire protection in the north difficult include extremely low temperatures, high winds, drifting snow, dry air, long heating seasons, community isolation, and the lack of adequate roads. There is also the problem of who mans the fire equipment, a paid or volunteer brigade. In most cases a combination is desirable. The prime requirement of any system is its readiness to serve. Another factor that must be considered is the level of protection needed to reduce insurance rates. Too often towns that do develop good systems are not rewarded with lower rates because they are too small for differential rates. (See also W81-01381) (Seigler-IPA)
W81-01392

FIRE PROTECTION IN THE NORTH,
Construction for the Government of the Northwest Territories, Yellowknife Safety Div.
L. Adrian.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 225-229. 1 Fig.

Descriptors: *Canada, *Northwest Territories, *Fire Protection, *Cold regions, Protection, Standards, Fire extinguishers, Building codes, Fire brigades, Education, Smoke detectors, Fire halls, Zoning, Organizational structure.

The Fire Prevention Ordinance of the Northwest Territories is designed to provide the best fire protection within the limits of the economic factors of the area. The Northwest Territories have many extremes since they cover approximately one third of Canada. The population of 46,000 people is scattered over this area making fire protection difficult. The Fire Marshall must record all reported fires, report annually to the Commissioner, and review building plans to ensure that they conform to standards. Building codes require at least two fire extinguishers in every home and the Yellowknife and Inuvik areas require smoke detectors in every area with sleeping quarters. The Department of Local Government purchases fire protection equipment for all settlements including hamlets; villages, towns, and cities purchase their own. Due to the varying terrain of the area, a standard for equipment is not possible. Every community has organized fire brigades that are, in general, volunteer. Fire hall complexes consist of a combined fire hall and settlement office with a two-bay garage and training facilities. Zoning codes provide for proper distances between buildings and students are trained in the use of fire extinguishers. (See also W81-01381) (Seigler-IPA)
W81-01393

FIRE PROTECTION CONSIDERATIONS IN REMOTE, COLD REGIONS COMMUNITIES,
Indian Health Service, Window Rock, AZ. Navajo Area Indian Health Service.
W. L. Ryan.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 230-233.

Descriptors: *Fire protection, *Cold regions, *Sprinklers, *Building codes, Protection, Fire extinguishers, Smoke detectors, Fire hydrants, Insurance, Cost analysis, Water distribution, Value engineering, Risks, Burning.

Fire is a major problem in cold regions and practical solutions must be used rather than relying on the standard solutions suited for more temperate areas. The great danger from fire in cold areas comes from the length and severity of the heating season, lack of adequate water distribution, high winds, and poor roads. Due to the high cost of water distribution, the fire codes and prevention standards superimposed by insurance companies are not realistic for small isolated northern communities. The primary goal of saving lives can be aided in the north by having adequate fire escapes, well marked exits, smoke alarms, and community fire alarm systems. Sprinkler systems should be installed in homes and public buildings. Other good protection measures include a faucet in the home with a garden hose attached and hand operated fire extinguishers. Fire hydrants and tank truck systems have often proved ineffective in cold regions due to the elapsed time in getting to a fire, and fire hydrants that are frozen. Several communities have novel approaches such as the use of the airport snowblower in Unalakleet, Alaska, to dump snow on burning buildings. (See also W81-01381) (Seigler-IPA)
W81-01394

FIRE PROTECTION IN ISOLATED NORTHERN COMMUNITIES,
Office of Dominion Fire Commissioner, Ottawa (Ontario).
R. G. Whatmough.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5,

October, 1980, p 234-236.

Descriptors: *Canada, *Fire protection, *Cold regions, Fire extinguishers, Burning, Protection, Building codes, Combustion, Water distribution, Sprinklers, Standards, Fire departments.

Factors affecting fire protection in northern areas include the following: a long continuous heating season, the prevalent use of combustible building materials, poor road conditions, lack of trained tradesmen for services and repairs to equipment, and the use of portable water instead of piped water. The National Building Code of Canada and the National Fire Code set standards to aid in providing fire protection for northern communities. However, the building code is based on an adequate water supply with a full-time fire department while most northern communities have a volunteer fire department and a portable water supply. Due to this, an early alerting system and a regular fire inspection program are essential. The water supply needed for fire protection is determined by building size, type of construction, occupancy classification, fire fighting response time, fire fighting capability, and exposures to building. Often the water supply to a building does not provide sufficient pressure for a sprinkler system. In this case, pressure tanks filled with water and air at all times can be used. Despite the damage that water can cause, especially when it freezes, it remains the most general, all-round efficient extinguishant for controlling structural fires. (See also W81-01381) (Seigler-IPA)
W81-01395

SANITATION FACILITIES OPERATION AND MAINTENANCE IN ALASKAN NATIVE VILLAGES,
Alaska Area Native Health Service, Anchorage.
D. R. Rogness.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 239-247.

Descriptors: *Alaska, *Public utilities, *Operation and maintenance, *Sanitary engineering, *Sewers, *Water works, *Reliability, Education, Management, Maintenance costs, Operations, Cold regions, Inspection, Water systems, Hydraulic structures.

For three years the Alaska Area Native Health Service has conducted a program to provide maximum support to Alaska Native villages in the operation and maintenance of their water and sewer systems. The program does not directly subsidize the operation and maintenance of a system, rather it prepares and trains the village operators and citizens so that they are able to increase the reliability of system operations. After funding but prior to design and construction, a trained team visits a village several times to explain design alternatives and the amount of maintenance required by each. The village's responsiblity for operation and maintenance is stressed. This has lead to the selection of simpler central-type facilities that are less expensive and easier to operate and maintain. During construction, village operators receive on-site training that is followed by a five-day formal training course geared to the educational and expertise levels of the individuals, and to their own particular systems. Once a system is in operation maintenance specialists visit at least twice a year to provide on-the-job training for local operators and to perform any repairs that are beyond the operator's ability. Finally, an operation and maintenance manual is developed for each individual system using extensive pictures of all the components of the actual system. (See also W81-01381) (Seigler-IPA)
W81-01396

OPERATION, MAINTENANCE AND MANAGEMENT ASSISTANCE FOR RURAL SANITATION FACILITIES,
Alaska State Dept. of Environmental Conservation, Juneau.
J. W. Sargent.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 248-259. 2 Ref.

Descriptors: *Alaska, *Sanitation facilities, *Operation and maintenance, Rural areas, Cold regions, Public utilities, Sanitary engineering, Water works, Education, Management, Operations, Maintenance costs, Water systems, Public health.

The Alaska Village Safe Water (VSW) program, administered by the Alaska Department of Environmental Conservation (ADEC), conducts an operation and maintenance support program that offers financial, technical, and management assistance to the villages that have VSW sanitation facilities. A dominant feature of the program is the delegation of management program activities, as much as possible, to the villages themselves. Efforts are made to minimize direct State involvement in the management of VSW facilities. Villages may choose to accept the assistance and enter into a contract with ADEC and agree that funds will be spent according to the contract. Grant needs vary from 0 to 85% of the operating budget for a facility depending upon the village. Professional and technical services are provided by a field engineer who holds a separate contract with each village. He must be a 'Jack-of-all-trades' and must perform all activities reasonably required for administration, management, operation, and maintenance of a facility. A commercial bookkeeping firm handles the funding of the money to the villages. This VSW program is not a long-term solution to operational problems, but is simply designed to prevent the failure of existing VSW facilities before a solution is available. (See also W81-01381) (Seigler-IPA)
W81-01397

SOLVING SNOW-DRIFTING PROBLEMS AT BAKER LAKE, N.W.T., USING SNOW-MODELLING TECHNIQUES,
Interdisciplinary Engineering Co., Winnipeg (Manitoba).
K. M. Adam, and R. Piotrowski.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 394-408. 1 Fig, 1 Ref.

Descriptors: *Cold regions, *Model studies, *Snow drifting, *Snowpacks, *Snow management, Snow, Hydraulic models, Winter, Hydraulic similitude, Testing, Canada, Flumes, Northwest Territories, Winds, *Baker Lake(NWT).

Three hydraulic models were constructed for snow modelling at Baker Lake, a community of 1100 people located 240 km south of the Arctic Circle. The terrain is barren allowing snow to blow into the settlement from many kilometers to the north and it is common for several houses to be completely buried in winter. One model was a scale of one to one thousand of the whole townsite and surrounding terrain. A strip through Baker Lake parallel to the prevailing wind direction was modelled at one to four hundred. The third model, at a scale of one to four hundred was of the area of the proposed recreation center. Models were made of wood, concrete, and plasticine. The models were tested in a hydraulic flume with sand introduced into the water to simulate blowing snow. Results show that large obstructions upwind of the townsite will reduce the drifting problem. Staggered intermittent barriers of end-dumped or pushed up snow are more effective than a continuous barrier. Baker Lake constructed snow barriers at designated locations and they kept a previously impassable road from the settlement to the airport open. Sand-water modelling can help to find solutions to snow drifting at reasonable costs because the cost of model construction and testing is minimal compared to the construction of untested field solutions that fail. (See also W81-01381) (Seigler-IPA)
W81-01405

6D. Water Demand

QUENCHING THE THIRST FOR POTABLE WATER IN ARID SAUDI ARABIA,
American Water Works Association Research Foundation, Denver, CO.
For primary bibliographic entry see Field 6A.
W81-01287

DEVELOPMENT OF IMPROVED WATER MANAGEMENT PRACTICES IN PAKISTAN,
Colorado State Univ., Fort Collins. Engineering Research Center.
For primary bibliographic entry see Field 6A.
W81-01328

DOMESTIC WATER CONSUMPTION IN URBAN AREAS: A CASE STUDY IN IBADAN CITY, NIGERIA,
Ibadan Univ. (Nigeria). Dept. of Geography.
F. O. Akintola, and O. Areola.
Water Supply and Management, Vol 4, No 5/6, p 313-321, 1980. 1 Fig, 7 Tab, 3 Ref.

Descriptors: *Domestic water, *Water consumption, *Planning, Water management, Ibadan(Nigeria), *Nigeria, Water utilization, Projections, Water supply, Domestic water.

A study of residential water use in an upper middle class area of Ibadan, Nigeria, was undertaken to provide information for estimating future public water needs. Results of surveys in 565 households in three distinct areas show that residents in the more modern sections have a much higher water consumption (86 liters per day) than the national average (46 liters per day). Although the consumption rate is near that in advanced countries, most households surveyed are not yet equipped with appliances which use large quantities of water. Major uses of water are in toilets, floor scrubbing, car washing, and bathing. Water consumption is related to availability. For example, car washing uses 18 liters in areas where water is carried in buckets; 72 liters when hoses are available. Planners must base estimates of future water needs, not only on total population, but also on expected improvements in socio-economic status and living standards, which increase per capita water consumption. Policies proposed to limit excessive water use are water meters, increased rates, and modification of appliances. (Cassar-FRC)
W81-01333

6E. Water Law and Institutions

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN, GOALS AND OBJECTIVES, 1982-1986.
Minnesota Univ., St. Paul. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156648, Price codes: A05 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, November, 1980. 82 p, 11 Fig, 8 Tab, 26 Ref.

Descriptors: *Minnesota, *Research priorities, *Planning, *Research and development, *Water resources, Water utilization, Water quality, Waste water(Pollution), Water conservation, Optimum development plans, Water policy, Water supply, Institutions, Water distribution(Applied), Wetlands, Water pollution, Groundwater, Water analysis, Water quality control, Water resources planning, *Five-year plans.

The State of Minnesota 1982-1986 five-year water resources plan includes a review of the State's water resources, their current and projected uses, water and related land planning and development activities, problems, and concerns of citizens groups and agencies, priorities of the Water Resource Research Center, and the five-year research, development, and technology transfer plans of the Center. Problems most urgently perceived as needing research were classified into five

area categories, with the State locations or agencies that expressed the research need indicated in the category sub-area listings. The prioritized categories (and sub-areas) were: (1) water quantity, supply, and distribution research needs (resource inventory, groundwater hydrology, water supply and storage); (2) water quality research needs (pollution standards, water quality data and data collection, health aspects, protecting groundwater from pollution, non-point source pollution, point source pollution, and waste water handling/purification); (3) conservation and water use efficiency (wetlands, storage/reuse); (4) economic/social/institutional (regional planning/feasibility, public education, data and information); and (5) water resources management (management of non-point pollution/wetlands/floods, data and prediction, water recycling/reuse, and water energy relationships). (Zielinski-IPA)
W81-01207

REGIONAL FIVE-YEAR (1982-1987) WATER RESOURCES RESEARCH: GOALS AND OBJECTIVES.
Utah Center for Water Resources Research, Logan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156622, Price codes: A03 in paper copy, A01 in microfiche. Pacific Southwest Region, Report submitted to the Office of Water Research and Technology, December, 1980. 37 p, 10 Tab, 8 Ref.

Descriptors: *Southwest U.S., *Research priorities, *Planning, *Research and development, *Regional analysis, *Water resources planning, Regions, Pacific coast region, Water resources, Water utilization, Water quality, Water pollution, Water conservation, Optimum development plans, Water supply, Water policy, Institutions, Water distribution(Applied), Runoff, Water analysis, *Five-year plans(Pacific SW region).

State five-year water resources research programs have been prepared for Arizona, California, Colorado, Nevada, New Mexico, and Utah. This regional plan has drawn on the State plans for descriptive information on State water resources, water uses and needs, research and planning activities, and water management problems to assist the identification of regional priorities for collective research. Fifteen regional research topics were identified and priority ranked as very high or high. Those topics rated as having very high regional priority were: (1) legal/institutional aspects of allocation of new (including cloud seeking, evaporation suppression, water harvesting) and newly quantified water supplies, and reallocation of existing supplies; (2) conjunctive management of surface waters and groundwaters; (3) contamination of groundwaters and surface waters by heavy metals, organics, and other toxic materials; (4) salt pickup processes in surface waters and movement through channels/reservoirs, for use in more effective water management and methods of salinity control; and (5) effects of mining activities (metals, fossil fuels, and others) on surface runoff, water quality, and groundwater movement and quality. These priority topics were assigned to separate States for assembling regional research teams. (Zielinski-IPA)
W81-01209

PROTECTING INSTREAM FLOWS IN MONTANA: YELLOWSTONE RIVER RESERVATION CASE STUDY,
Cooperative Instream Flow Service Group, Fort Collins, CO.; and Fish and Wildlife, Fort Collins. Western Energy and Land Use Team.
D. A. Sweetman.
Instream Flow Information Paper No 10, Report FWS/OBS-79/36, September, 1980. 85 p, 24 Ref, 5 Append.

Descriptors: *Water allocation(Policy), *Water law, *Streamflow, *Water permits, Montana, Water utilization, Non-consumptive use, Competing uses, River flow, River basins, Water rights, Wildlife conservation, Water quality, *Yellowstone River Basin(MT).

The method used by the Montana Board of Natural Resources and Conservation in making water reservation determinations in the Yellowstone River Basin is reviewed to provide information as to the usefulness of this form of water allocation. While the Yellowstone has a mean annual flow of 8.8 million acre feet, the all-time low was approximately 4.1 million acre feet: in some years it is possible to satisfy all water uses, while in other years many users will be unsatisfied. The Montana Water Use Act of 1973 established a permit system for all new water rights, and recognized instream rights. Thirty water reservation requests were submitted to the board, including nonconsumptive use requests for almost the entire average flow to protect wildlife, recreation and water quality. The reservations established by the Board's actions secured water rights provided for minimum stream flows, and allowed for future water utilization in areas other than those addressed under the reservation process. Implementation of the instream flows granted in the Yellowstone Basin may serve to protect the continued existence of one of the Nation's last remaining free-flowing rivers. The reservation process appears to have been well accepted in this case, with only two parties appealing the decisions. (Moore-SRC)
W81-01219

INSTREAM FLOW NEGOTIATION: REVIEW OF PRACTICES,
M. R. White, F. D. Valdez, and M. D. White.
Fish and Wildlife Service, Biological Services Program Report FWS/OBS-80/53, September, 1980. 78 p, 26 Ref.

Descriptors: *Negotiations, *Streamflow, *Water rights, Attitudes, Legal aspects, Decision making, Water utilization, Flow rates.

This review summarizes research, findings, and recommendations of practitioners in the art of negotiation, and applies them to negotiations undertaken to preserve and protect instream flows. Negotiation is a method of social decision-making, consisting of choices involving another party, accomplished by persuasion and haggling. Negotiators may choose between clear-cut alternatives, but more often must balance and weigh values on the way to an agreement. Negotiators may or may not define the issues in the same way, gradually converge toward a compromise situation, agree on the value of issues, and agree on relative bargaining power. Most negotiations involve both bargaining and debate. Negotiators cooperate to increase their common interest as well as their individual interests. It is difficult to find a single standard by which to judge negotiation, negotiators, or outomes. Bargaining reputation is extremely important, and face-saving is a powerful motive in negotiation. Negotiators are reluctant to yield or concede a point and are unwilling to acknowledge concessions they have made. For this reason, concessions may occur only in the context of a trade. Negotiating behavior is shaped by the context for negotiation, including the issues, their complexity, the team structure, and the team style. (Moore-SRC)
W81-01230

STATE OF THE STATES: WATER RESOURCES PLANNING AND MANAGEMENT.
Water Resources Council, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182975, Price codes: A08 in paper copy, A01 in microfiche. Report, April, 1980. 153 p, 10 Tab, 37 Ref, 4 Append.

Descriptors: *Planning, *Water resources, *Water management(Applied), *Water quality control, State governments, Water supply, Regional development, Water law, Overdraft, Erosion, Floods, Wetlands, Permits, Legislation, Flood plains, Comprehensive planning, Water resources development.

This study was conducted to take stock of water resources planning and management trends at State and regional levels, as well as those water resources issues that confront State and regional efforts. It provides an overview of quality and quantity planning and management activities and summarizes the current status of State water quality planning, regulation, standard setting, wastewater facility construction, and other management activities. Virtually every State and region is experiencing a range of water resources problems, the most frequently noted being: overdraft of groundwater; erosion and sedimentation of river banks; and flooding, caused by the development of wetlands and floodplain, and insufficient management techniques. States' legislative authorization for addressing water resources problems vary widely. Two states, Delaware and Florida, have recently mandated totally comprehensive approaches to the planning and management of water resources, while 27 additional States have authorized some form of comprehensive water resources planning. Western states have tended to integrate water quality planning and management functions into a single agency, while northeastern States have been more apt to integrate water quality and quantity planning into a single agency. The legislative trend in the management of water resources is towared the establishment of some sort of permit system. (Moore-SRC)
W81-01233

EVOLUTION OF THE WATER AND SANITATION POLICY AND PROGRAM IN THE NORTHWEST TERRITORIES,
Construction for the Government of the Northwest Territories, Yellowknife Dept. of Local Government.
V. Christensen.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 9-18.

Descriptors: *Canada, *Northwest Territories, *Water policy, *Cold regions, *Sanitary engineering, Waste disposal, Plumbing, Public health, Sewage, Water storage, Water supply, Sewage disposal, Sewerage, Environmental sanitation.

Since its establishment in 1976, the Water and Sanitation Section of the Department of Local Government has made substantial progress with the problems of water and sanitation services in the Northwest Territories. Despite this progress another six to eight years will be needed to provide an acceptable level of service across the Territories. Although the first Northwest Territories Council was established in 1875, it was not until the 1960's that the need for improved water and sanitation services was recognized. Prior to 1976 most of the area's water policies were inefficient due to inadequate funding and lack of engineering experience with the cold climate. Current policy is being modified on an ongoing basis to develop a policy compatible with the prevailing social and economic conditions in the Territories. A major impediment to improved water and sanitation services remains the poor standard of housing in the northern communities. All new houses are now being provided with larger water and sewage storage tanks to end the need for bagged sewage collection. Projects are also underway to inform the public of the reasons and management methods for proper garbage collection and disposal systems. (See also W81-01381) (Seigler-IPA)
W81-01382

6G. Ecologic Impact Of Water Development

EFFECTS OF ALTERATIONS TO LOW GRADIENT REACHES OF UTAH STREAMS,
Utah Cooperative Fishery Research Unit, Logan.
R. S. Wydoski, and W. T. Helm.
Fish and Wildlife Service, Biological Services Program, Report FWS/OBS-80/14, April, 1980. 178 p, 48 Fig, 45 Tab, 130 Ref, 6 Append. 14-16-008-1141.

Descriptors: *Stream improvement, *Sport fish, *Invertebrates, *Fish populations, Channel morphology, *Utah, Streambeds, Dredging, Aquatic habitat, Stream erosion, Fish reproduction, Stream

fisheries, *Environmental effects, Biomass, Flood control, Trout, Ecology.

Stream channels in the semi-arid intermountain west have been modified for many years by agricultural interests, primarily to provide flood protection. Of special concern is the relationship between stream channel modification and the high value fishery resource. This report describes an investigation of the effects of stream channelization on fish and macroinvertebrates in low gradient reaches of Blacksmith Fork River and the Logan River in the floodplain of Cache Valley in northern Utah. Dredged, recently bulldozed, and old bulldozed sites, plus two control areas, were selected for study. Erosion and deposition of streambed gravel were directly correlated with the percentage of stream reach that was altered. High stream flows in spring appeared to be required to maintain the depth and frequency of pools. Channelization adversely affected both fish and macroinvertebrate populations and biomass, with the severity of impact directly related to the amount and duration of disturbance of the physical habitat. In all bulldozed sites the trout populations were not self-sustaining. Dredging had less effect than bulldozing on survival of age 0 fish, but dredging may reduce spawning in the future. Water temperature, water chemistry, sampling information, a macroinvertebrate list, and length and weight information on invertebrates is provided in microfiche appendices. (Moore-SRC)
W81-01224

SUMMARIES OF RIPARIAN AND STREAM ALTERATION STUDIES COMPLETED BY THE EASTERN ENERGY AND LAND USE TEAM.
Fish and Wildlife Service, Kearneysville, WV. Eastern Energy and Land Use Team.
For primary bibliographic entry see Field 10C.
W81-01228

WESTERN STATES INVENTORY OF LOW-HEAD HYDROELECTRIC SITES, VOLUME 2, APPENDIX D, ENVIRONMENTAL SCREENING.
Tudor Engineering Co., San Francisco, CA.
Water and Power Resources Service Report, October, 1980. 283 p. DV-00031.

Descriptors: *Sites, *Hydroelectric plants, *Social aspects, *Environmental effects, Recreational facilities, Parks, Natual resources, Wildlife habitats, Wild rivers, Scenery, Federal reservations, Public lands, Data collections, Water resources development, Reservoir sites, Regional analysis, Western states.

The low-head hydroelectric sites left after the preliminary economic sizing and analysis were screened to identify those which indicated the highest promise of development based on environmental and social concerns. A broad data base was developed that identified the location and potential seriousness of recognized constraints on future hydropower developments. A graduated system of constraint categories was developed, designating them as either Serious, Potentially Serious or Minor. Serious constraints include: wild, scenic and recreational rivers; listed wilderness areas; areas established as parks, monuments, refuges, and wildlife managment areas; areas listed as historical places, landmarks, and research natural areas; and areas established as critical habitats for endangered or threatened species. Potentially Serious constraints are those that have high probability in the future, or upon further project feasibility investigations of being serious constraints. Minor constraints are those which could be overcome with reasonable mitigation measure, and which would probably not preclude development, such as National Forests. This information is provided in tabular form for sites in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. (Moore-SRC)
W81-01232

EFFECTS OF ALTERATIONS TO LOW GRADIENT REACHES OF UTAH STREAMS: SUMMARY,
Utah Cooperative Fishery Research Unit, Logan.
R. S. Wydoski, and W. T. Helm.
Fish and Wildlife Service, Biological Services Program, Report FWS/OBS-80/13, April, 1980. 17 p, 8 Fig. 14-16-0008-1141.

Descriptors: *Stream improvement, Sport fish, *Invertebrates, *Fish populations, Channel morphology, *Utah, Streambeds, Aquatic habitat, Stream erosion, Dredging, Stream fisheries, *Environmental effects, Biomass, Flood control, Brown trout.

Stream channels in the semi-arid intermountain west have been modified for many years by agricultural interests, primarily to provide flood protection. Of special concern is the relationship between stream channel modification and the high value fishery resource. This report summarizes an investigation of the effects of stream channelization on fish and macroinvertebrates in low gradient reaches of Blacksmith Fork River and the Logan River in the floodplain of Cache Valley in northern Utah. Erosion and deposition of streambed materials were directly correlated with the length of stream that was altered and the type of alteration. Channelization adversely affected both fish and macroinvertebrate populations and biomass, with the severity of impact directly related to the amount and duration of disturbance of the physical habitat. Populations, biomass and production of brown trout and mountain whitefish appeared to be directly related to the proportion of the stream reach that contained pools. (Moore-SRC)
W81-01234

WATER QUALITY AND ENVIRONMENTAL IMPACT MODEL OF THE UPPER NILE BASIN,
Royal Danish School of Pharmacy, Copenhagen. Dept. of Chemistry.
S. E. Jorgensen.
Water Supply and Management, Vol 4, No 3, p 147-153, 1980. 4 Fig, 1 Tab, 6 Ref.

Descriptors: *Model studies, *Water quality, *Nile River, River basin development, Watershed management, River systems, Future planning, Surveys, Environmental effects, DDT, Eutrophication, Zooplankton, Nutrients, Snails, Irrigation, Industries.

The HYDROMET project, which is an international survey effort on the Nile River Basin, has been given approval for expansion into a water quality model to give information on lakes, eutrophication, aquatic life, irrigation, industrial wastes and environmental impact. To meet all of these objectives accurately, more comprehensive biological data collection procedures have been adopted with storage of information into a data base, and submodels have been formulated which will feed data into the system. Areas of focus of the smaller models include algal growth, zooplankton, fisheries, nutrient exchange between sediment and water, mass balances of P, N, Si, O, and C, a bilharziosis (snail) model, DDT, Cu and the water and salt balance. Flow charts for each submodel and calibration data are examined to simplify the understanding of the main model. The water quality model will be an important management tool in the Lake region as this area becomes more developed. The model will also help in the decision making process and in the planning of environmental policy. An example of the application of the model to the decision making process on a contrived scheme to build an ammonia fertilizer factory in the area is given. The model will require an intensive training program on its proper use plus a system of dynamic feedback from applied situations to ensure its validity in comprehensive planning and water quality management. (Geiger-FRC)
W81-01330

7. RESOURCES DATA

7A. Network Design

SURFACE WATER DATA, ATLANTIC PROVINCES, 1979.
Water Survey of Canada, Ottawa (Ontario). Inland Waters Directorate.
Report, 1980. 111 p.

Descriptors: *Surface water availability, *Gaging stations, *Canada, *Streamflow, *Basic data collections, Monitoring, Flow measurement, Bodies of water, Surface waters, Rivers, Running waters, Water resources, Streams, Data collections, On-site data collections, Hydrologic data, Measurement, Networks, Stations, Statistics, Flow rates, Discharge(Water), Water levels, *Atlantic Provinces(Canada).

Surface Water Data reports have been published in various formats in imperial units since 1908 in approximately 270 publications. This is the first report presented in the International System of Units (SI). The format has remained the same, with Canada divided into eight regions. The provinces usually each represent a separate region, but the Atlantic Provinces region is comprised of New Brunswick, Newfoundland, Nova Scotia, and Prince Edward Island. The present report covered the results of the hydrometric survey investigations made in the Atlantic Provinces (including Labrador) for the 1979 calendar year. These data are published annually on a calendar year basis, and the stations are listed alphabetically, with yearly data on two stations given per page. The general method for data tabulation included (1) a table of daily water level or discharge, (2) a summary of monthly and annual data, and (3) descriptive information (such as gauge type, gauge location, drainage area). (Zielinski-IPA)
W81-01214

SURFACE WATER DATA, YUKON AND NORTHWEST TERRITORIES, 1979.
Water Survey of Canada, Ottawa, (Ontario). Inland Waters Directorate.
Report, 1980. 88 p.

Descriptors: *Basic data collections, *Canada, *Gaging stations, *Surface water availability, *Streamflow, Monitoring, Flow measurement, Bodies of water, Surface waters, Rivers, Running waters, Water resources, Streams, Data collections, On-site data collections, Hydrologic data, Measurement, Networks, Stations, Statistics, Flow rates, Discharge(Water), Water levels, *Yukon, *Northwest Territory(Canada).

Results of the hydrometric survey investigations are presented in terms of daily discharge rates (cubic meters per second) for each day of 1979 for the various stations in the Canada region represented by the Yukon and Northwest Territories. This is one of eight regions that Canada is divided into for the purpose of these Surface Water Data compilations. Surface Water Data reports have been published in various formats in imperial units since 1908 in approximately 270 publications. This is the first report presented using the International System of Units (SI). These data are published annually on a calendar year basis. The report represents the data of the stations alphabetically, with yearly data on two stations per page. The general method for data tabulation for each station has included (1) a table of daily discharge rates or daily water levels, (2) a summary of annual and monthly data, and (3) descriptive information (such as gauge type, gauge location, and drainage area in kilometers). Highest annual discharge rates generally occur within the May-September time-frame. (Zielinski-IPA)
W81-01215

WATER QUALITY MONITORING--SOME PRACTICAL SAMPLING FREQUENCY CONSIDERATIONS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.

J. C. Loftis, and R. C. Ward.
Environmental Management, Vol 4, No 6, p 521-526, November, 1980. 2 Fig, 15 Ref.

Descriptors: *Sampling, *Water sampling, Monitoring, *Water quality, Mathematical studies, Network design, Water analysis, Illinois, Frequency, Seasonal.

Relationships between water quality sampling frequency in a monitoring network and the effect of statistical methods and assumptions on sampling frequency were examined. Detailed data from the Illinois State Water Survey network was studied using 3 methods: (1) considering neither seasonal variation nor serial correlation (the most widely used method), (2) considering only seasonal variation, and (3) considering both seasonal variation and serial correlation (assumed to be the most accurate method). Confidence level widths for each were plotted as a function of sampling frequency, which were divided into 3 regions with zones of uncertainty between each region. In Region 1 (sampling interval, 1-12 days), Method 3 is most accurate; in Region 2 (sampling interval, 12-34 days), Method 1 or 3 apply; and in Region 3 (sampling interval greater than 34 days), Method 1. (Cassar-FRC)
W81-01257

SAMPLING AND THE REGULATORY MAZE IN THE UNITED STATES,
Illinois Environmental Protection Agency, Springfield.
D. J. Schaeffer, J. B. Park, H. W. Kerster, and K. G. Janardan.
Environmental Management, Vol 4, No 6, p 469-481, November, 1980. 1 Fig, 52 Ref.

Descriptors: *Sampling, *Regulation, *Water quality standards, Illinois, Monitoring, Water pollution control, Cyanide, Ammonia, Standards.

The problem of sampling is related to the maze of environmental regulation in the United States. Actions that develop from regulations affect sampling, and conversely, analyses and sampling are used as a basis for setting standards. Procedural problems are illustrated by the example of the dieldrin residue limit for animal feed established by the U.S. EPA. This standard was set by relying on the fish bioaccumulation factor rather than acute and chronic toxicity data, arriving at a value of 0.005 ppb, which is not detectable except by the most refined research techniques. This makes routine sampling and analysis suspect. Suggestions are made for improvements to the National Pollutant Discharge Elimination System reporting system, to make the data received more useful. Testing and analysis problems are illustrated by the cyanide standards hearings held in Illinois, which took 3 years to develop a 0.005 mg per liter standard, a level which requires development of new analytical methods. Two groups within EPA are now working on the ammonia effluent standards, making possible a double set of regulations. Recommended sample preservation procedures are frequently impractical and expensive. However, in the case of phenol sampling, only one general sentence was given as instruction. Further problems involve collection of composite samples, trace organic compounds, rounding of results, and lack of objectives described for the data acquired. (Cassar-FRC)
W81-01258

ANALYTICAL ISSUES IN COMPLIANCE MONITORING,
J. K. Rice.
Environmental Science and Technology, Vol 14, No 12, p 1455-1457, December, 1980. 2 Tab.

Descriptors: *Water analysis, *Monitoring, Data collection, Data acquistion, Analytical techniques, Measurement.

Modifications are suggested to ensure accurate results in compliance monitoring for pollutant dischargers. It is suggested that steps which will be followed both inside and outside the laboratory for the analysis of water samples be specified in the outlined standard method. These steps are deemed essential to the reliable performance of monitoring. A determination of the overall precision of the monitoring method is needed. The method which is designed and accepted must be applied only to the matrices for which it was validated. When the precision of a method has been determined for a single matrix, this does not allow it to be used universally. Terms used in the process of measurement must be accurately and consistently defined. (Baker-FRC)
W81-01261

ERROR DETECTION SYSTEM FOR CLIMATIC AND HYDROLOGIC DATA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
J. C. Carr, V. O. Shanholtz, and B. B. Ross.
Transactions of the ASAE, Vol 23, No 5, p 1127-1130, October/November, 1980. 1 Fig, 6 Ref.

Descriptors: *Data processing, *Computer programs, *Climatic data, Error detection, Hydrologic data.

This paper summarizes the data error detection phase of the climatic and hydrologic data management program. The package consists of 3 programs, an error diagnostic program which scans input data for errors detectable by computer-based algorithms, a program which updates and corrects basic data files, and a third program, which detects errors in the recording of timing of precipitation and runoff events from a given watershed. Examples of errors detected by this system are gross mistakes in depth and change in a given time increment, incorrect designation of Standard or Daylight Saving Time, evaporation loss in rain gauges, and data out of the proper sequence. (Cassar-FRC)
W81-01276

WATER QUALITY AND ENVIRONMENTAL IMPACT MODEL OF THE UPPER NILE BASIN,
Royal Danish School of Pharmacy, Copenhagen. Dept. of Chemistry.
For primary bibliographic entry see Field 6G.
W81-01330

7B. Data Acquisition

DETERMINATION OF DEUTERIUM/HYDROGEN RATIOS IN NATURAL WATERS BY FOURIER TRANSFORM NUCLEAR MAGNETIC RESONANCE SPECTROMETRY,
Hong Kong Univ. Dept. of Chemistry.
R. S. Tse, S. C. Wong, and C. P. Yuen.
Analytical Chemistry, Vol 52, No 14, p 2445, December, 1980. 2 Ref.

Descriptors: *Isotope studies, *Deuterium, Hydrogen, Spectrometers, Analytical techniques.

A multinuclear Fourier transform nuclear magnetic resonance spectrometer was used to determine deuterium/hydrogen isotope ratios in natural waters. A 2 ml water sample and an internal working standard of lithium iodide in 2% deuterium-enriched acetone were used. Calibration of the standard was done by adding known volumes of deuterium oxide to a sample. Results obtained were as follows: International Atomic Energy Agency V-SMOW No. 268, 155.6 + or - 0.12 ppm (IAEA value, 155.76 + or - 0.05 ppm); SLAP No. 259, 88.8 + or - 0.18 ppm (IAEA value 89.02 + or - 0.05 ppm); local tap water, 153.5 + or - 0.2 ppm. (Cassar-FRC)
W81-01244

CYTOSOME MORPHOGENESIS IN NERVE CELLS AND LATERAL CILIO-INHIBITION IN THE MUSSEL, MYTILUS EDULIS,
Southern Illinois Univ. at Carbondale. Dept. of Anatomy.
A. Paparo, and J. A. Murphy.
Journal of Submicroscopic Cytology, Vol 12, No 4, p 547-562, 1980. 12 Fig, 47 Ref. OWRT-B-119-ILL(1), 14-34-0001-9069.

Descriptors: *Cytological studies, *Aquatic animals, *Mussels, Physiological ecology, Mollusks, Aquatic environment, Light, Temperature, Effects, Central nervous systems, Gills, *Radioisotopes, Analytical techniques.

Visceral ganglion, branchial nerve and gill preparations were studied in the mussel, Mytilus edulis. The ganglia and nerves contain yellow pigment granules (Cytosomes) which are ultrastructurally altered in response to visible light (490 nm). The frequency of the conversions in cytosomes (immature, mature, paracrystalline and lamellar formation) are directly related to the duration of light exposure and temperature. Autoradiographic/radioisotopic incorporation studies indicated that the Golgi apparatus plays a role in the formation of these neutonal pigment granules. The percentage of lamellar type granule conversions can also be influenced by gradual anoxic conditions, i.e., treatment with pentylenetetrazole or dopamine, or high frequency branchial nerve stimulation. Microspectrofluorometric analyses indicate that these parameters also change the absorption spectra of the yellow pigment in cytosomes. Furthermore, lateral cilio-inhibition is observed in those preparations with the greatest number of 'secondary conversions' of cytosomes in their neutons. The magnitude of this cilio-inhibition seems to be related to the percentage of lamellar transformations in cytosomes. Since sequestered calcium has been shown to be released from lamellar-type granules, it is postulated that the cilio-inhibition observed in this study is due to an increase in the neuronal intracellular (Ca+ +) with subsequent release of the cilio-inhibitory agent, dopamine.
W81-01268

PRESSURE TRANSDUCER FOR REMOTE DATA ACQUISITION,
Robert S. Kerr Environmental Research Lab., Ada, OK.
C. G. Enfield, and C. V. Gillaspy.
Transactions of the ASAE, Vol 23, No 5, p 1195-1196, 1200, October/November, 1980. 5 Fig, 25 Ref.

Descriptors: *Transducers, *Pressure measuring instruments, *Remote sensing, Manometers, Instrumentation, Soil water, Irrigation.

An inexpensive pressure transducer, applicable to most water management and research needs, has been developed for automated data acquisition in the field. This device, based on a standard mercury manometer, is linearly temperature-dependent and gives a frequency output as a function of pressure output. Construction materials are nylon tubing, stainless steel tubing, shielded cable, vented cap, multivibrator circuit, nichrome electrode, mercury, and a container for mercury. Measurements, calibrated within 1 mbar, were tested over a range of 0.2 to 0.8 bars. The capacitance of the transducer is transformed to audio frequency, which can be transmitted through shielded cables without frequency shift or impedance loading to the output transistors. (Cassar-FRC)
W81-01271

MODELLING GROUNDWATER CONTAMINATION FROM LAND-APPLIED SWINE WASTE,
British Columbia Univ., Vancouver. Dept. of Bio-Resource Engineering.
B. R. Cappelaere, and T. H. Podmore.
Transactions of the ASAE, Vol 23, No 5, p 1147-1152, October/November, 1980. 7 Fig, 19 Ref.

Descriptors: *Farm wastes, *Nitrates, *Aquifers, Groundwater movement, Water table, Mathematical models, Water pollution sources, Leaching, Fertilizers, British Columbia, Soil contamination, Hogs.

A one-dimensional model was used to simulate water table fluctuations and nitrate distribution in order to improve waste management practices. The specific problem was a shallow, unconfined aquifer in British Columbia used as a source for residential water and for raising livestock. Liquid

swine waste was applied to a 5 hectare pasture on the upper reaches of the aquifer. The model, based on the flow and convection/dispersion equations, was used to estimate nitrate loading leached to the groundwater and nitrate concentration profiles. Observed and predicted water table fluctuations agreed closely. (Cassar-FRC)
W81-01273

A FIELD EVALUATION OF THE HASL WET-DRY DEPOSITION COLLECTOR,
Department of Energy, New York. Environmental Measurements Lab.
D. C. Bogen, S. J. Nagourney, and C. Torquato.
Water, Air, and Soil Pollution, Vol 13, No 4, p 453-458, December, 1980. 2 Fig, 3 Tab, 9 Ref.

Descriptors: *Sampling, *Rain gages, American Samoa, *Sea spray, Precipitation gages, *Chemical analysis, Sampling, Methodology, Equipment, Wet-dry deposition collector.

The efficiencies of a HASL (Health and Safety Laboratory) wet/dry deposition collector and a total collector were compared at Tutuila Island, American Samoa. At this location, wet deposition is exclusively rain; sea spray aerosol is the major source of dry deposition. Volumes of water deposited in duplicate wet/dry collectors were within 4% of the rain gauge measurements after corrections for evaporation were made. The wet and dry sides of the HASL collector picked up about 90% of Cl(-), SO4(--), Ca(++), Na(+), Mg(++), and K(+) compared with the total collector, which is continuously exposed to the atmosphere. Results for Ca(++) and K(+) were variable because of analytic uncertainties at the low concentration in the samples. These differences in collection efficiencies were not considered significant. (Cassar-FRC)
W81-01351

LARGE SCALE DEVELOPMENT OF REMOTE HOUSING IN SUBARCTIC AREAS,
R and M Consultants, Inc., Anchorage, AK.
W. A. Robertson, and R. L. Schreader.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 426-438. 4 Fig, 6 Ref.

Descriptors: *Alaska, *Terrain unit mapping, *Aerial photography, *Photogrammetry, Remote sensing, Permafrost, Septic tanks, Soil disposal fields, Permeability, Soil physical properties, Waste disposal, Sewage disposal, Terrain analysis, Geomorphology, Mapping, Topographic mapping, Surveys.

Terrain unit analysis was used to analyze 1,862 ha at Glennallen, Alaska, to aid in compliance with water and sewer regulations pertaining to the land prior to its transfer from State control to private control. Terrain unit analysis consists of identifying landforms by airphoto interpretation and defining the variations of geotechnical conditions for each landform by actual ground truth observations and borings. This method was successfully used on the Trans-Alaska Pipeline Project. For the Glennallen project, all available aerial photographs were collected and a preliminary terrain unit map was produced. Some of the area was covered by a previous engineering geologic map and this map was used for cross checking. Next, high quality 1 cm = 120 m aerial photographs were obtained for detailed photogrametric mapping. A limited amount of field truth was done to substantiate the mapping results. Three separate cases or ground types were observed from the analysis and recommendations were made as to lot size, suitability for on-site sewage disposal, and maximum recommended density. The Alaska Department of Environmental Conservation approved the mapping results and parts of the area were opened to the public in 1979. The use of terrain unit mapping rather than conventional techniques allowed substantial savings in both time and money in the development of this remote housing project. (See also W81-01381) (Seigler-IPA)
W81-01407

8. ENGINEERING WORKS

8A. Structures

STUDIES OF UTILITY CONSTRUCTION IN COLD REGIONS,
Ontario Ministry of the Environment, Toronto.
M. Fielding.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Aberta, Report No EPS 3-WP-80-5, October, 1980, p 136-139. 1 Fig, 5 Ref.

Descriptors: *Canada, *Ontario, *Utilities, *Water works, *Cold regions, Freezing, Frost heaving, Manholes, Soil temperature, Concrete pipes, Insulation, Polystyrene, Stress gauges, Muskeg, Heat of fusion, Water temperature.

On-going, problem oriented work on utility delivery in the Province of Ontario is reported. Population centers between 45 and 50 degrees North with a January design temperature range from -20 to -40C are being used. Trenching in muskeg and Precambrian rock is generally involved in utilities construction in these areas. An initial study involved temperature monitoring in the soil surrounding an insulated watermain. The watermain consisted of 30 km of 600 mm reinforced concrete pipeline buried to a cover of 1.1 m and insulated with a 50 mm by 2.5 m slab of polystyrene. Although frost penetration was greater than expected, freezing of the pipe contents did not occur probably due to the latent heat of fusion of the contents. Data from this study prompted an analysis of the theoretical aspects of pipeline freezing. Analysis results concluded that existing standard theory can be used to calculate design temperatures at any given depth in the soil and from this the residence time above which pipe contents will freeze can be determined. On-going studies include a soil temperature measuring project at Keewatin, Ontario, and an induced stress project on precast concrete manholes at Thessalon, Ontario. (See also W81-01381) (Seigler-IPA)
W81-01388

CRITICAL EVALUATION OF INSULATED SHALLOW BURIED PIPE SYSTEMS IN THE NORTHWEST TERRITORIES,
Construction for the Government of the Northwest Territories, Yellowknife Dept. of Public Works.
F. W. James.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 150-186. 44 Fig.

Descriptors: *Northwest Territories, *Canada, *Public utilities, *Cold regions, *Plastic pipes, Freezing, Insulation, Water conveyance, Manholes, Hydrants, Permafrost, Pipelines, Sanitary engineering, Cost analysis, Thawing, Freeze-thaw tests.

Experiences from the sad and expensive history of piped utility system in northern permafrost regions has lead to the design of an insulated shallow buried pipe system that appears to be a good standardized economically practical, northern pipe system. The water system has a single pipe recirculation design consisting of one or more uninterrupted loops coming from a recirculating facility and returning to that facility without branch systems. It operates as a normal gravity system. Water and sewer transmission mains are individually insulated and are placed in the same trench. The pipes are high density polyethylene covered with insulation of high density urethane. The outermost pipe cover is an extruded impermeable plastic jacket. Back up freeze protection systems include heat trace, thaw tubes, thaw wires, and bleeding. Pipes are continually joined by butt fusion. Service manholes are large enough to permit servicing inside and are placed at a maximum spacing of 100 m. The shallow buried system minimizes energy input for operation, is simple to operate and maintain, allows maximum use of short construction seasons, can be drained, has a minimum 20-year design life, minimizes on-site labor, and is economically practical. (See also W81-01381) (Seigler-IPA)
W81-01390

PRE-INSULATED HIGH DENSITY POLYETHYLENE PIPING -- THE EVOLUTION OF A NORTHERN ACHIEVEMENT,
Du Pont of Canada Ltd., Mississauga (Ontario). Pipe Div.
A. D. Whyman.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 187-220. 18 Fig, 5 Ref.

Descriptors: *SCLAIRCOR, *Canada, *Cold regions, *Plastic pipes, *Public utilities, Freezing, Thawing, Plumbing, Sanitary engineering, Water supply, Sewage, Sewers, Water delivery, Water works, Insulation, Polyurethane, Polyethylene, Pipelines, Piping systems(Mechanical).

Du Pont of Canada's SCLAIRCOR pre-insulated piping system has been greatly refined and improved since its introduction in 1976 so that it is now a desirable system for utilities in northern regions. SCLAIRCOR is composed of three elements: SCLAIRPIPE high-density polyethylene pipe and fittings, factory-applied rigid polyurethane foam insulation and fittings insulation covers, and ECONOTRACE parallel-resistance heat tracing cable and accessories. An extruded polyethylene jacket is used as a cover for underground applications while a spirally formed galvanized steel or aluminum cover is used above ground. All components are manufactured in Canada and the pipe is shipped in 38 or 50 foot lengths. Sections are joined by butt fusion. By 1979 more than 200 installations had been made for a total of approximately 305,000 m. The evolution of many basic configurations and applications has lead to a moratorium on design changes and a prime concern for standardization. Du Pont also offers extended product information and aids for planning and design such as the PIPETEMP Thermal Analysis program, the HYDTRAN Hydraulic Transient Analysis, and the SESME Stress Evaluation for Marine Applications. (See also W8101381) (Seigler-IPA)
W81-01391

THE APPLICATION OF SKIN EFFECT CURRENT TRACING FOR FREEZE PROTECTION OF WATER SYSTEMS,
RICWIL, Inc., Brecksville, OH.
R. W. Tracey.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 263-287. 17 Fig, 2 Tab.

Descriptors: *Skin Effect Current Tracing, *Cold regions, *Pipelines, *Freezing, Pipes, Utilities, Water works, Heating, Water temperature, Heat transfer, Electric currents, Electrical grounding, Electrical properties, Insulation, *Heated pipelines.

Skin Effect Current Tracing (SECT), a circuit comprised of a carbon steel heat tube and an insulated, stranded copper heating cable, provides a unique, reliable method of electrically heating pipe line systems. SECT uses an AC power source to pass the heating current through the cable with the circuit being completed by the current passing through the heat tube and back to the power source. Due to the ferromagnetic properties of the heat tube and the skin effect, the maximum penetration of current density through the wall of the heating tube is only 0.9 mm. The skin effect is the concentration of the return current near the inner surface of the tube. The skin effect makes SECT electrically safe and allows the piping system to be grounded. SECT also has a reliable automatic temperature control that controls pipe temperature well within + or - 5%. Existing installations account for over 250 SECT traced lines in operation for a 15 year period. SECT heating can be adapted to a wide variety of piping systems according to region environment and functional application needs. This heating system features very efficient heating, energy savings, reliability, low mainte-

nance, and favorable operating costs. (See also W81-01381) (Seigler-IPA)
W81-01398

ELECTRIC HEAT TRACING AND ENERGY CONSERVATION FOR NORTHERN INSTALLATIONS,
Thermon Mfg. Co., San Marcos, TX.
B. C. Johnson, R. K. Pitzer, and G. Tarbutton.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980. p 288-309. 8 Fig, 11 Tab, 6 Ref.

Descriptors: *Electrical mining, *Heat tracing, *Energy conservation, *Cold regions, Electrical resistance, Electrical properties, Electrical impedence, Electrical equipment, Electrical design, Electric cables, Public utilities, Pipelines, Water works, Freezing, Monitoring, *Heated pipelines.

The conservation of energy and money for electric heat tracing of northern pipe installations requires well-sealed, economically-selected thermal insulation, a dependable control system, and a heating cable that matches the thermal requirements of the system. The selection of proper insulating material considers thermal characteristics, mechanical properties, chemical requirements, moisture resistance, health and safety, and cost. The insulation must be dry for proper operation of an electrically traced system. The two most common types of weather barriers for field installed insulation are metal jacketing and mastics. Types of heating cables available today include resistance heating cable or tapes in either series or parallel, Skin Effect Current Tracing, impedence heating, and induction heating. Resistance heating is most widely applied for freeze protection and general process temperature maintenance. Circuit controls available include mechanical controllers, electronic controllers, thermocouple sensing elements, radiation or optical pyrometers, and metallic or non-metallic thermoresistive sensory elements. Heating elements are monitored and alarmed to assure operational status. Required design consideration are listed and discussed. (See also W81-01381) (Seigler-IPA)
W81-01399

THAWING OF FROZEN WATER SERVICES,
Western Water and Sewer Supplies (1978) Ltd., Edmonton (Alberta).
R. Currey.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October 1980, p 310-313. 1 Fig.

Descriptors: *Thawing, *Freezing, *Water works, *Cold regions, *Pipes, Insulation, Water temperature, Hot water, Pipelines, Electrical equipment, Electric currents, Soil temperature, Frost protection, Public utilities.

Electrical thawing and hot water thawing are the two accepted methods of thawing frozen service lines. Despite compliance with design criteria stating that all utility service lines must be installed below the normal frost level, subsequent activities such as street grading, driveway excavation, and sidewalks can cause freeze ups due to lack of soil cover. Thawing with electricity involves passing an electrical current through the service line pipe to increase the temperature and melt the ice. Gasoline powered welders can be used to provide the electrical energy. Asbestos cement water mains with copper service lines are thawed by using 200 to 300 amps ranging from 10 to 40 volts for a few minutes. Electrical thawing must be done by qualified people due to the hazards of stray electrical currents. Hot water thawing is internal thawing done by including hot water directly into the problem area. This method is preferred over electrical thawing because all types of service lines can be thawed with the hot water probe, initial equipment costs are less, it is quicker, and less labor is required. After thawing further freeze ups can be prevented by lowering the grade of the line, increasing insulation, increasing ground cover, changing traffic patterns, or continuous bleeding. (See also W81-01381) (Seigler-IPA)
W81-01400

THERMODYNAMIC ANALYSIS OF THE WATER DISTRIBUTION SYSTEM IN INUVIK, NWT,
Associated Engineering Services Ltd., Edmonton (Alberta).
J. A. Hull.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 332-346. 5 Fig.

Descriptors: *Utilidors, *Inuvik, Northwest Territories, *Freezing, *Protection, Computer programs, Computer models, Cold regions, *Pipelines, Soil temperatures, Mathematical models, Model studies, Water works, Thermal properties, Water distribution.

HYDROTHERM, a computer program that simulates the hydraulic and thermodynamic aspects of a pipe network was used to analyze the thermal behavior of Inuvik's utilidor system. Inuvik is in an area of highly thaw sensitive permafrost, and a variety of utilidor designs with various freeze protection methods have been used in an attempt to reduce extremely high capital costs. HYDROTHERM has nine active programs run in an automatic self-generating order. The program is iterative with pressure, flows, and temperatures calculated and corrected from one iteration to the next. Heated and unheated utilidors were considered separately because their circulation and thermal effects are extremely different. Results show that freeze protection in the heated utilidors may be marginal for extended cold weather periods. Also, in these heated utilidors, freeze protection under extreme conditions is partly dependent on water demand. Unheated utilidors appear to have adequate freeze protection under present and proposed operating conditions, with the exception of one section. Results also show that the use of heat lost from heating pipes as a means of protection is inefficient and difficult to control, while forced circulation and heat addition directly at selected locations was efficient and controllable. (See also 81-01381) (Seigler-IPA)
W81-01402

WATER DISTRIBUTION PIPE NETWORKS FOR ARCTIC SETTLEMENTS,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
W. James, and M. A. Robinson.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 347-363. 1 Tab, 4 Ref.

Descriptors: *Canada, *Computer programs, *FASTPIPE, *Networks, Public utilities, Algorithms, Optimization, Data processing, Model studies, Cold regions, Mathematical models, Freezing, *Pipelines, Water distribution, Computer models, Design criteria.

The FASTPIPE computer program, which uses a variety of individually operating algorithms to aid in the design of water distribution networks, was upgraded using interactive conservational software to produce a fast, efficient, easy-to-use method for computing optimum designs for Canadian pipe distribution systems. Algorithms used in FASTPIPE include an algorithm for pressure and flow analysis, an algorithm for optimum design of pipe networks, and an algorithm for the optimum design of materials and devices for protecting utilities against freezing. The use of interactive design dialogue leads the user through a pipe distribution system design by requesting, at various stages, specific input while still allowing the user, at any point, to change the sequence. The package is comprised of two distinct separate programs, NETWORKOPTIMIZE (NETOPT), an interactive design of a cost effective network operating under steady state conditions, and ARCTIC, an interactive design of an optimal continuous or pulsed system. The package was used to design the optimal layout for the Broughton Island network and to determine the optimum power and insulation requirements for that system. The package is commercially available to dial-up terminals in most North American cities. (See also W81-01381) (Seigler-IPA)
W81-01403

8B. Hydraulics

APPROXIMATE ANALYSIS OF UNSTEADY LAMINAR FLOW,
RCA Research Center, Princeton, New Jersey.
D. Stavitsky, and E. Macagno.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY12, p 1973-1980, December, 1980. 3 Fig, 4 Ref.

Descriptors: *Mathematical models, *Pipe flow, *Water pressure, Pressure conduits, Flow resistance, Fluid friction, Movement, Fluctuations, Engineering, Model studies, Hydraulics, Variability, Reynolds number, *Laminar flow, *Unsteady flow.

Many problems have been encountered with solutions of unsteady laminar flow of incompressible fluids in circular pipes due to varying pressure differences. Lengthy and cumbersome mathematical calculations often result when the Uchida or Szymanski equations are applied to this situation. An approximate model is proposed to simplify the calculations of unsteady flow, and the method is checked for validity with exact solution models. Results showed that errors introduced by the new technique are relatively small, while time savings in calculations are large when compared to exact solution methods. The solution for any pressure variation and any conduit cross-sectional shape for which uniform flow solutions are available can be listed in terms of one simple integral. The average friction coefficient may be obtained as a function of an average Reynolds number, the oscillatory mean pressure difference ratio, and the Stokes number. The proposed mathematical model allows any oscillatory flow in a conduit to be handled as steady flow when corrections are made for the average resistive force. (Geiger-FRC)
W81-01367

8C. Hydraulic Machinery

WIND GENERATED ELECTRIC POWER FOR SANITATION SERVICES -- A CASE STUDY,
Ellerbe Alaska, Fairbanks.
M. A. Crawford, and T. J. Bergin.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 89-104. 6 Fig.

Descriptors: *Alaska, *Wind power, *Power sources, *Cold regions, *Electric power production, Water wells, Water supply, Standby power, Design data, Project post-evaluation, Pumping, Cost analysis, Sanitary engineering, Public utilities, Water works.

The utilization of wind-generated electric power, battery power storage, water storage, single point gravity delivery in the small village of Council, Alaska, indicates that wind power systems are a very viable alternative to conventional diesel generator power sources in remote Alaskan villages in windy regions. Council is approximately 50 miles east-northeast of Nome and has approximately 30 permanent residents. A well was drilled in the center of the village and electric motor-driven submersible well pump was installed. A wind generator/battery prime electrical power system was installed for the design average wind speed of 19.3 km/h with a design calm period of four days. For a calm of more than four days a standby diesel generator is activated. A 6.4 m by 3.35 m building was constructed to accomodate the water storage tanks, well space heater, battery bank, inverter wind generator control panel, standby generator, and arctic entry vestibule. A project cost of $56,711 indicates that the wind generator and associated auxiliaries have an 8.7 year payback. Two small operational problems have been corrected and the system has withstood three blizzards, an

ice storm, and winds in excess of 129 km/h. (See also W81-01381) (Seigler-IPA)
W81-01385

8D. Soil Mechanics

USE OF A GEOTHERMAL MODEL IN NORTHERN MUNICIPAL PROJECTS,
EBA Engineering Consultants Ltd., Edmonton (Alberta).
D. Kent, and C. T. Hwang.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 317-331. 6 Fig, 13 Ref.

Descriptors: *Geothermal studies, *Computer models, *Cold regions, *Pipelines, Freezing, Thawing, Computer programs, Soil temperature, Mathematical models, Data processing, Model studies, Water works, Meteorological data, Thermal properties.

A computerized geothermal model was developed for design feasibility study of northern pipelines. The model predicts the thermal response of the soil to changes in the thermal environment such as those resulting from a chilled or heated pipeline, construction of a building or embankment, or an alteration of ground surface properties. The model program has a thermal conduction code with a finite element formulation of the transient heat conduction mechanism of freezing and thawing. The ground surface heat exchange code simulates the heat exchange mechanism at the ground surface using meteorological data. The model was verified against measured temperatures from a Canadian Arctic Gas Pipeline facility. Excellent agreement was observed. Steps involved in model application include the collection of site information, selection of thermal properties, model calibration, and two-dimensional analysis. Case histories are given for model use with the Dawson City, Yukon water and sewer system and the Norman Wells water tank. (See also W81-01381) (Seigler-IPA)
W81-01401

8F. Concrete

TETON DAM-FOUNDATION GROUT TESTING PROGRAM,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
R. J. Bard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-132417, Price codes: A03 in paper copy, A01 in microfiche. Report REC-ERC-79-2, December, 1979. 39 p, 29 Fig, 3 Tab, 8 Ref.

Descriptors: *Grouting, *Calcium chloride, *Dam failure, *Materials testing, Construction materials, Water-cement ratio, Dam construction, Dam foundations, Permeability, Mechanical properties, Strength of Materials, Hydration, *Teton Dam(ID).

After failure of Teton Dam in Idaho on June 5, 1976, a program was initiated to test foundation grouts similar to those used during construction of the dam. Grouts were made with the same cement, sand, bentonite, and calcium chloride used during construction, using mix proportions representative of grouts used, and mixed and cured as congruently to field conditions as possible. All mixes produced grouts exhibiting good hydration properties and good physical soundness. The inclusion of calcium chloride in grout mixes apparently did not cause formation of any compounds or substances which would be water soluble or erodible. Consideration should be given to specifying an upper limit of about 6% calcium chloride, by weight of cement, for sanded foundation grouts. Variations in the grout temperature at the end of the mixing period did not have adverse effects on grout. Although grouts tested were not impermeable, their relative permeability is low enough to preclude significant waterflow. Large amounts of bleeding, in grouts with high water to cement, and water to cement to sand ratios seem relatively inconsequential. (Moore-SRC)
W81-01237

8G. Materials

POLYESTER-RESIN ANCHOR CREEP STUDY,
Water and Power Resources Service, Denver, CO.
D. G. Miller.
Report GR-80-5, June, 1980. 16 p, 6 Fig, 3 Ref.

Descriptors: Binders, *Creep, *Rock bolts, *Materials testing, Adhesives, Loads(Forces), Bonding, Polyester resins, *Engineers estimates, Design criteria.

Mechanical rock bolt anchors have long been a weak link in obtaining full utilization of the strength of a rock bolt, and sometimes are totally unsatisfactory in certain types of rock. This research was initiated to determine the sustained and ultimate load carrying capacity of a polyester-resin type anchor. In the laboratory, a reinforcing steel rock bolt was anchored in a concrete cylinder using a polyester-resin cartridge type anchor. A load was applied to the rock bolt and anchor immediately following resin hardening and the system was monitored for load relaxation. Load data were gathered for 21 months. Early and sustained load carrying capabilities were impressive, with a load reduction of only 27% from the time of final retensioning to the end of periodically monitored readings 21 months later. The creep rate appeared to decrease as a function of both time and decreasing load. The anchorage remained in a tensioned state for the next 40 months, although the load was not monitored. After a total of 61 months the anchorage was tested to failure in a pull-out test. The strength of the resin bond exceeded that of the reinforcing steel bolt, which failed at a load of 229 kN (51,500 lbf). Resin anchors have been used on several Water and Power Resources Service Projects with great success. (Moore-SRC)
W81-01235

ST. LOUIS COUNTY STANDARDIZES PIPE AND PROCEDURES FOR RELIABILITY.
Water and Sewage Works, Vol 127, No 12, p 44-45, December, 1980. 3 Fig.

Descriptors: *Pipes, *Water conveyance, St. Louis County Water Company, Distribution systems, Joints(Connections), Metal pipes, Reliability, Specifications, Costs, Installation, Maintenance, Corrosion control.

Use of ductile iron pipe has shown many advantages in the St. Louis County Water Company system since this material was first installed 20 years ago. All standardized pipes and fittings couple with push-on gasketed joints. Pipe is palletized for easy shipment and storage. Corrosion is minimized by coating with cement and asphalt and wrapping with 8-mil polyethylene. Reinforced concrete squares are used as thrust blocks for 6 and 8 diameter pipes. The Company has a very small incidence of joint leaks, traceable to improper installation or corrosion. Ductile iron pipe can tolerate error in pipe laying procedures. Although costs vary with conditions, estimates for a 6 in iron pipe are as follows: first 400 feet, $12.68 per foot; next 600 feet, $12.24 per foot; over 1000 feet, $8.96 per foot. The cost of laying 8 in pipe adds $3.10 per foot to the figures for the 6 in pipe. Properties and costs of ductile iron and cast iron pipes are compared in a table. (Cassar-FRC)
W81-01343

8I. Fisheries Engineering

CEDAR RIVER SOCKEYE SALMON PRODUCTION, 1980,
Washington Univ., Seattle. Fisheries Research Inst.
Q. J. Stober, and A. H. Hamalainen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156655, Price codes: A04 in paper copy, A01 in microfiche. Completion Report FRI-UW-8016, September, 1980. 59 p, 17 Fig, 8 Tab, 36 Ref, 1 Append. OWRT-A-103-WASH(1), 14-34-0001-0151.

Descriptors: *Sockeye salmon, *Incubation, *Washington, *Fish diseases, *Fish harvest, Fish handling facilities, Fish management, Salmon, Aquatic animals, Aquatic life, Fish, Salmonids, Commercial fish, Marine life, Marine animals, Sport fish, Wildlife, Infection, Hatching, Fish hatcheries, Fish populations.

The 1979 Cedar River escapement of sockeye salmon was estimated at 185,300 spawners that were the progeny of the 1975 brood year that had been impacted by the maximum flood on record. River discharge during the 1979 spawning season was regulated along the critical year flow curve, due to extant drought conditions. National egg survival was probably reduced by a moderate flood in mid-December. Fry estimated to have entered Lake Washington totalled 14,900,000 (including 5,100,000 sockeye fry estimated to have survived from 9,700,000 artifically-produced fry from the Washington Department of Fisheries incubation facility). The egg-to-fry survival rate for the entire run was 4.0%. The infection rate due to hematopoetic necrosis viral disease (first detected in fry in the incubation boxes and fyke net catches simultaneously, and in all returning adults sampled) declined to low level after all fry emigrated from the enhancement facilities. The 1976 and 1978 brood years were comparable, but 1978 escapement was doubled. Egg-to-fry survival was 8.1, 4.5, and 4.0 for the 1976, 1978, and 1979 brood years, respectively. The number of pre-emergent fry has increased with enhancement production. (Zielinski-IPA)
W81-01206

EVALUATIONS OF A BYPASS SYSTEM FOR JUVENILE SALMONIDS AT LITTLE GOOSE DAM,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
J. R. Harmon, and D. L. Park.
Marine Fisheries Review, Vol 42, No 6, p 25-28, June, 1980. 2 Fig, 1 Tab, 5 Ref.

Descriptors: Dam design, Bypasses, *Chinook salmon, *Smolt, Conduits, *Dams, Fish migration, Fish behavior, Seasonal, Snake River, *Fish passages, Salmon, Fish guiding.

A new system for bypassing juvenile chinook salmon at the Little Goose Dam on the Snake River is proposed, and the existing system at Little Goose is evaluated. The orifice diameter, lighting, and placement in turbine intake slots of the test system were evaluated, along with overall system efficiency during the migration of chinook salmon and steelhead smolts in April and May of 1978. Existing six inch orifices were blocked off, and 12 inch fingerling transfer pipes with 8 to 10 inch orifices were tested. Marked fish were used to determine the efficiency of the orifices. Two orifices are needed for satisfactory passage due to varying current directions. Also, lighted orifices increase passage rates for salmon. A complete system at Little Goose would include north and south, 12 inch diameter lighted orifices in the downstream walls of the bulkhead slots. (Small-FRC)
W81-01300

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

WESTERN ENERGY AND LAND USE TEAM PUBLICATIONS: A BIBLIOGRAPHY WITH ABSTRACTS.
Fish and Wildlife Service, Fort Collins, CO. Western Energy and Land Use Team.
Report W/COAL-80/W28, October, 1980. 55 p.

Descriptors: *Bibliographies, *Land use, *Wildlife, *Water utilization, Environment, Abstracts, Documentation, Water resources, Energy resources.

This bibliography contains an annotated list of Biological Service Program publications produced or sponsored by the Western Energy and Land Use Team and included in the FWS/OBS Publication Series. The Biological Services Program is responsible for the development and dissemination of information pertaining to fish and wildlife resources and habitats, while the Western Energy and Land Use Team is the Service's major technical research and development organization for the study of Western land and water use. Publications are listed in the order of their FWS/OBS numbers. Each bibliographic entry contains ordering information and a brief abstract. There are five separate indices: author index, corporate author index, funding source index, geographic index, and keyword subject index. The bibliography includes 87 publications.
W81-01227

SUMMARIES OF RIPARIAN AND STREAM ALTERATION STUDIES COMPLETED BY THE EASTERN ENERGY AND LAND USE TEAM.
Fish and Wildlife Service, Kearneysville, WV. Eastern Energy and Land Use Team.
Report, July, 1980. 44 p.

Descriptors: *Wildlife, *Bibliographies, *Stream improvement, Environmental effects, Abstracts, Channel improvement, Flood control, Fish, Vegetation, Bank stabilization, Water resources development.

The Fish and Wildlife Service began funding stream alteration and riparian studies in FY'73. This bibliography provides abstracts or executive summaries for studies completed by the Eastern Energy and Land Use Team through 1980 pertaining to the impact of stream channelization, bank stabilization, water level changes, gravel removal, and water resources development on vegetation, fish and wildlife. Thirty-four publications are included in this bibliography. (Moore-SRC)
W81-01228

10D. Specialized Information Center Services

TAPPING DRINKING WATER DATA: A PROTOTYPE SYSTEM,
Michigan Univ., Ann Arbor.
R. A. Deininger, R. P. Thomas, and R. M. Clark.
Journal of the American Water Works Association, Vol 72, No 11, Part 1, p 600-603, November, 1980. 12 Fig, 4 Ref.

Descriptors: *Water quality, *Potable water, *Data storage and retrieval, *Michigan University, Public utilities, Data collections, Documentation.

A prototype data analysis and management system developed by the University of Michigan and the EPA Drinking Water Research Division enables a user to search for data on the water quality of U.S. utilities. The data base, current to 1977, presently contains information on 45 water quality parameters in 1000 public water supplies. The inquiry language, designed for user convenience, resembles English and is used in an interactive, conversational form. Typical questions which may be answered by the system are as follows: What percentage of water supplies contain mercury from 0 to .002 mg/liter. How many New Jersey water supplies exceed the standard for nitrate, 10 mg/liter. How many suppliers have information on organics. (Cassar-FRC)
W81-01289

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Subject Fields

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